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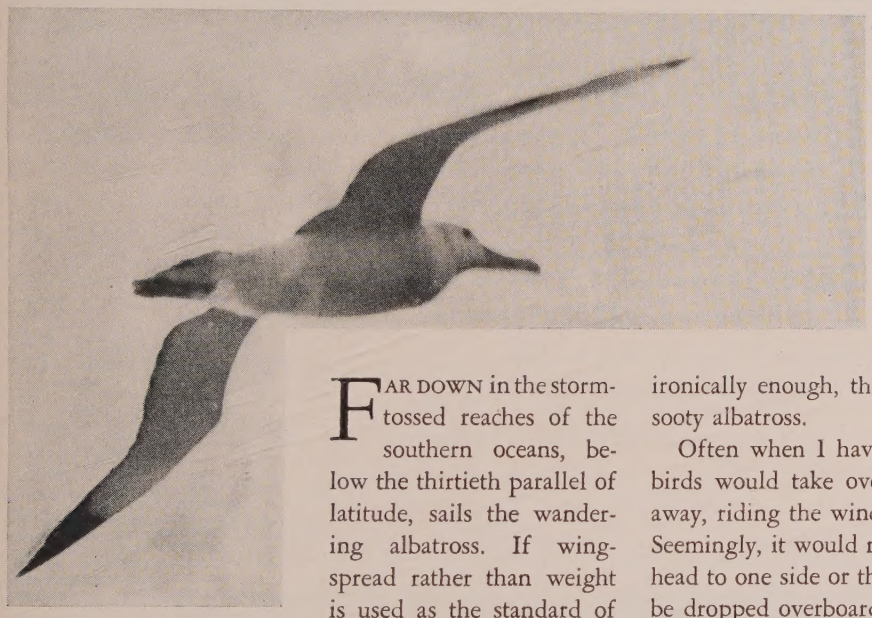
The Wandering Albatross

"In mist or cloud, on mast or shroud, It perched for vespers nine;"

By WILLIS LINDQUIST



Frontispiece by F. L. Jaques, courtesy of the American Museum of Natural History.

FAR DOWN in the storm-tossed reaches of the southern oceans, below the thirtieth parallel of latitude, sails the wandering albatross. If wing-spread rather than weight is used as the standard of comparison, it is the largest of all flying birds. Condors are actually heavier, but they are shorter of wing.

Many an hour have I stood at the taffrail watching the wandering albatrosses flying in our wake. Gliding would, perhaps, be a better word for their actions in the air. Rarely have I seen them flap their long narrow wings. Like feathery monoplanes, all white except for the tips and edges of the wings and the stumpy tail, they hold their wings rigid, making subtle adjustments to the constantly changing currents of air by tilting the whole body. Except when one wing is lowered to ease the bird into a beautiful banked turn you might well believe that the wings were fixed in place by stays.

While there are no less than nineteen species and subspecies of these birds, it is the wandering albatross, *Diomedea exulans,* that is usually thought of in connection with Coleridge's "The Rime of the Ancient Mariner." That poem represents the source of the average person's knowledge about this great bird, yet it has been proved, ironically enough, that Coleridge really had in mind the sooty albatross.

Often when I have stood at the rail one of the great birds would take over a position fifteen or twenty feet away, riding the wind with almost effortless indifference. Seemingly, it would not move a muscle, except to shift its head to one side or the other in search of food that might be dropped overboard at any moment.

Let one scrap be tossed into the sea and the bird would spot it at once, lower a wing and fall away in a gentle downward convolution that brought it a foot or so above the floating object. If the food looked interesting the bird would go on a hundred feet or more, wheel and come back to rest on the water.

In the air the albatross is a flying miracle. Its trough-of-the-waves flight, the easy sure way it flips out of one trough, clears a white crest of foam by inches and disappears into the next hollow is a breath-taking exhibition of its sense of distance. But when it attempts to land it is quite a different story. The bird loses that keen sense, usually flying twenty or thirty feet beyond its mark. Then its enormous webbed feet plough against the sea and it comes to a stop like a runner sliding into second base.

On our ship, a four-masted barque going round the Cape of Good Hope and bound for Australia, we fished for these birds with a V-shaped piece of heavy tin, the open ends of which were nailed to a block of wood in order to keep it afloat. Strips of salt pork were tied to

the sharp end of the V, and when the bird took this, the strong vulturine hook at the end of its bill could be wedged into the tin by pulling in the line. When caught, the bird always spreads its wings and thrusts its feet before it. This makes for rather heavy going for the man pulling the bird in, but it also keeps the line taut and the hooked beak securely wedged.

Once the albatross is landed on deck the contraption falls from its bill and it is none the worse for its experience. The bird is absolutely helpless on the rolling deck of a ship. Having in all probability been at sea for three or four months or more, it is not so strange that its legs have become too weak to support its body.

The albatross will struggle nobly to its feet, take a few deliberate steps with a wide, swinging gait like that of an extremely fat man, and then sag down and just sit there, looking unhappy about the whole thing. If anyone comes too close the bird snaps at them, making a resonant clapping sound.

The largest albatross we caught in this way was eleven feet and one-quarter inch from wing-tip to wing-tip. Its pinkish beak measured eight and one-half inches in length. To my astonishment I found all of these birds covered with huge flattish lice almost a third of an inch long.

A bird is never on deck very long before it appears to become seasick and gives up its food. Then it is time to return the albatross to its element. But throwing it into the air results only in a fall into the sea with a splash. So fixed is its pattern of flight that it is never able to recover itself when tossed into the air. On the theory that they might be able to get possession of their wings if given sufficient altitude, ornithologists have taken several of these birds to the brow of a cliff more than one hundred feet in height, carefully releasing them with wings outspread into what should have been graceful glides, but in each case the bird went plummeting to death on the rocks far below.

One of the most amusing things about the albatross is its take-off. Owing to the great length of its wings it cannot use full strong flaps when rising into the air. Instead, it turns to the wind, spreads its wings and runs on the water for anywhere from twenty to a hundred feet, depending on the strength of the wind and the size of its last meal.

During a flat calm it is difficult to find a wandering albatross on wing. They need the wind to glide on, and when the wind dies they settle on the water and remain there almost as helpless as a becalmed ship. This, perhaps, largely explains why the wandering albatross is rarely found north of latitude 30° S., where calms are frequent, the trade winds light, and flight à la albatross difficult.

It is my impression that the wandering albatross enjoys nothing so much as a strong wind, or even a gale. Then it is at its best; darting, wheeling, swooping, behind the ship one moment and far ahead of it the next; sometimes gliding between the sails as if to taunt them with its wild freedom. It almost seems of a piece with the wind itself.

Little wonder, then, that it remains in the great belt of the "Roaring Forties", and chooses for its breeding grounds the weather side of such wind-swept islands as Gough, South Georgia and Tristan da Cunha.

This bird's descent to solid earth usually takes the form of a minor accident. If the wind is good it makes a perfect three-point landing, on its breast and feet. But in a calm it strikes the ground so violently with its breast that it topples forward on its beak and frequently goes head over heels.

"At length did cross an Albatross,
Through the fog it came;
As if it had been a Christian soul,
We hailed it in God's name.

"It ate the food it ne'er had eat,
And round and round it flew.
The ice did split with a thunder-fit;
The Helmsman steered us through!

"And a good south wind sprung up behind;
The Albatross did follow,
And every day, for food or play,
Came to the mariners' hollo!"

COLERIDGE—*The Rime of the Ancient Mariner.*

The males come to the breeding grounds in October and November and await the females. Early in the season there are four or five males to each female. They crowd about her uttering queer noises, trying to touch beaks with her and draw her attention in every way possible.

She manages to keep her courtiers all pretty well flattered by a subtle division of attention, but sometimes there are too many. When that happens the male left in the cold becomes almost human. He walks slowly away with his head hanging almost to the ground and swings it from side to side as if to say, "Everything happens to me."

Within a few days there are enough females to go around. When a mate is found the pair begin at once to make their nest, a conical-shaped mound about two feet high and almost four feet in diameter at the base.

A speckled egg is laid in January, and the adults stay on the island and care for the young until June. In a calm an albatross goes to the top of a hill and runs down its slope until its speed is great enough to take it off. When it fails on one hill it seems to have enough sense to look for a higher one before making another attempt.

Once again in the air, the bird is supreme among its feathered kind. Where it goes, how far it flies, no one will ever know, because it is impossible to follow its flight except for the few days it might stay with a ship.

There are good reasons to believe, however, that the average albatross goes around the world many times during its life. An aluminum band was once fixed to the leg of a bird on the breeding grounds at Kerguelen Islands. Three years later it was captured on the other side of the globe, some 6083 statute miles away.

PHOTOGRAPH BY ROBERT CUSHMAN MURPHY

A WANDERING ALBATROSS ON ITS NEST IN ANTARCTIC SOUTH GEORGIA

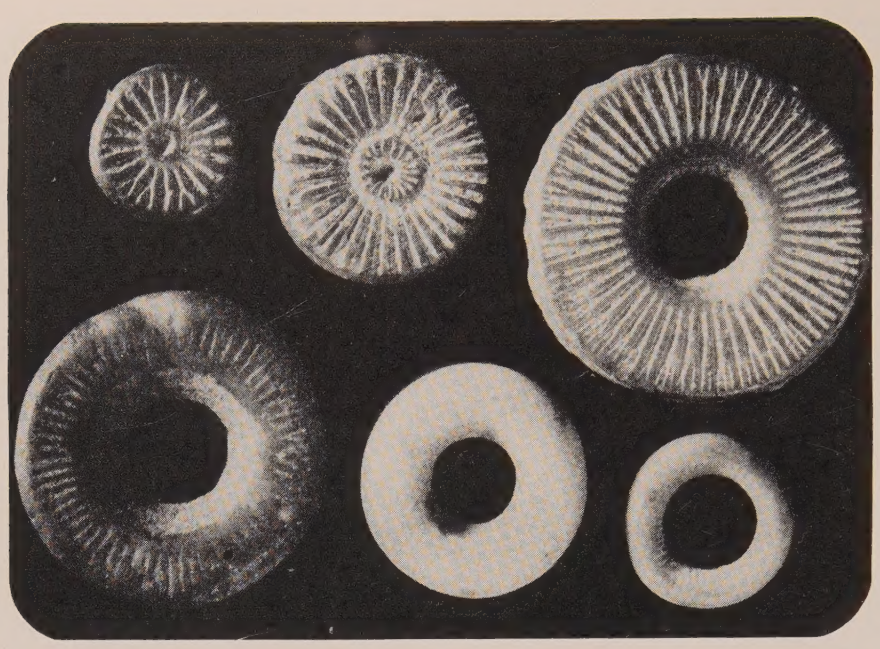
The nest is a conical mound about two feet high and almost four feet in diameter. In it a speckled egg is laid in January. Below is an albatross caught by the sailors on the four-masted barque from which the author observed this great sea bird. On a deck the albatross is unable to walk far

The Brown University Museum has a bird that holds something of a speed record. It was shot off the coast of Chile on December 20, 1847. In a vial tied round its neck was found this note:

"Dec. 8th, 1847. Ship Euphrates. Edwards, 16 months out, 2300 barrels of oil, 150 of it sperm. I have not seen a whale for 4 months. Lat. 43° S., long. 148° 40″ W. Thick fog, with rain."

During the twelve day interim between the writing of the note and the shooting of the bird it had traveled 3150 nautical miles as the crow flies. Two or three of those days probably could be deducted because there was thick fog and rain at the time of the bird's release, and it is a well known fact that these birds always stay on the water during such conditions. Then, too, an albatross is not believed to fly in a straight line, so its actual zigzag course was perhaps much more than the 3150 nautical miles indicated.

Truly this albatross rightfully earns its name, the Great Wanderer. Those who have had the good fortune to see it in flight, a silvery streak of wild freedom over the waves, can never quite cast off the enchantment of the experience.



SPECIMENS WITH RADIAL GROOVES

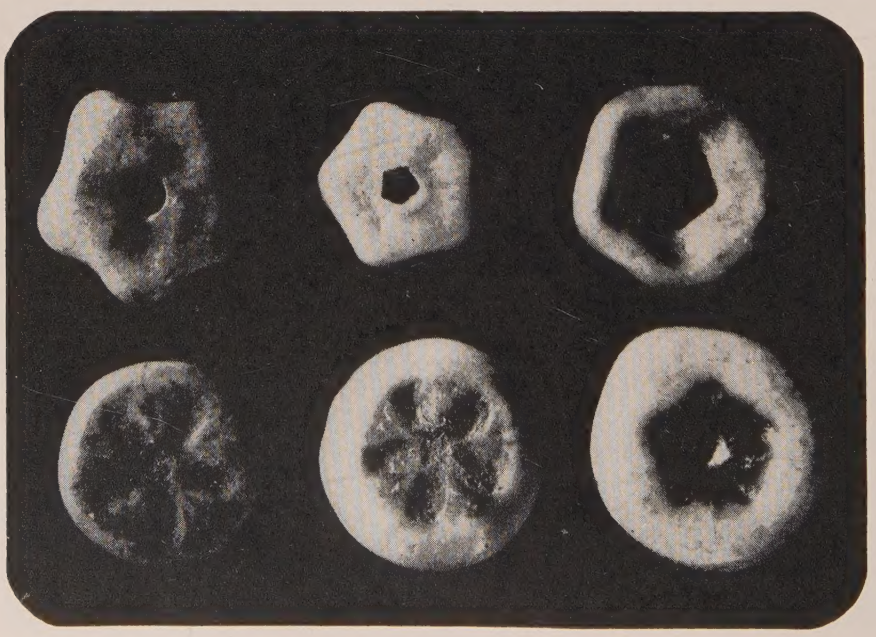
The "clock wheels" in this collection also illustrate various stages of weathering. Two of the specimens, upper right and left, show the frequent tendency of the grooves to branch; that in the upper middle shows no such marked characteristic

Clock Wheels

IF YOU were wandering along at the seashore and came across a full-grown man on his hands and knees searching diligently through a bed of fine gravel, apparently unconscious of the waves breaking around him, you would feel entitled to become curious. I know, for scores of times I've been surprised in just such a posture, and have invariably been asked what it is I am hunting. And I must confess that my usual reply, "I'm hunting for clock wheels," rarely seems to satisfy my questioners. In fact, it usually leaves them with an unfavorable impression of my general intelligence and some suspicion of "wheels" in my mental equipment. Yet hunting for "clock wheels" is exactly what they found me doing; and therein lies an interesting little bit of natural history.

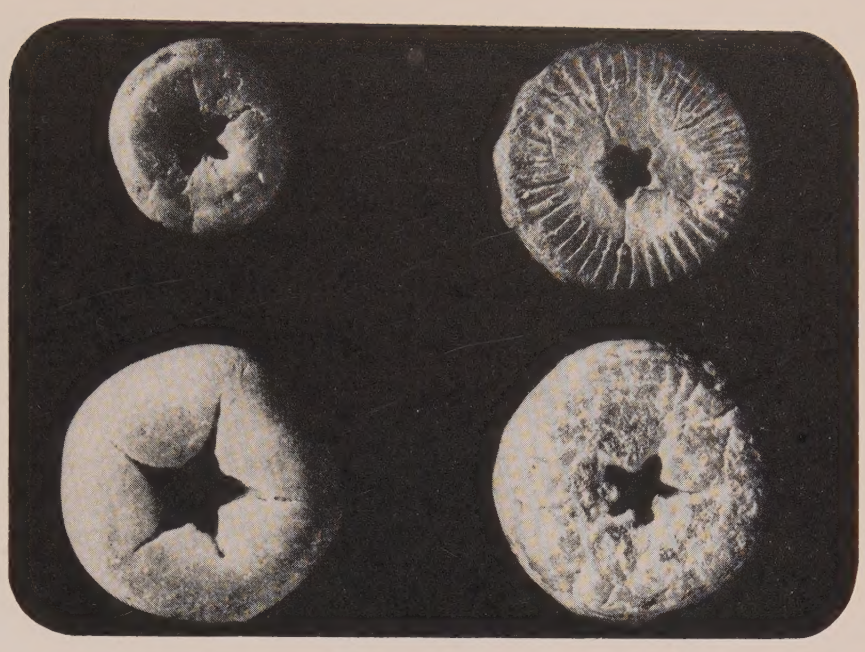
Hundreds of millions of years ago, in that great epoch in the earth's history that geologists call the Paleozoic Era, there flourished a group of marine animals known as crinoids. These were strange creatures, resembling plants a great deal more than they did animals. In fact the name Crinoidea is derived from the Greek words for lily-shaped animals. The present-day representatives of the family, closely related to such familiar forms as the sea urchin, the sea cucumber, and the starfish, are commonly called sea lilies. A typical specimen of Paleozoic days consisted of a long stem or stalk that branched out at the bottom into root-like processes, and expanded at the top into a cup-shaped body that had a number of arms extending from its rim like the petals of a flower. The root-like parts actually served to anchor the animal, for most types were not free swimming, while the arms, or "petals", served to sweep into its mouth the tiny forms on which the creature fed.

Like most other types of ancient life, these animals have been preserved as fossils, sometimes as entire individuals, to which the name stone-lily is rather naturally given. Whole specimens are rather unusual, but fragmentary remains, consisting principally of the individual segments of which the stem was composed, are common in many



SPECIMENS WITH VARIED DESIGN

Here we see some of the five-lobed design, examples of segments of pentagonal outline, and pentagonal central holes. The specimens in the upper right and upper middle illustrate two interesting variations. In the former, the sides of the central hole are parallel to the corresponding sides of the perimeter. In the latter, this is not the case but the central pentagon has been rotated, so to speak, so that its sides, if extended, would pass through the corners of the outer pentagon. The collector of crinoids will find them ever versatile



STILL FURTHER VARIATIONS HERE

These specimens of crinoids show the somewhat less common star-shaped hole in the center of the fossil. It is such differences in characteristics that make the search for and collection of these interesting relics a constant source of surprise to enthusiasts

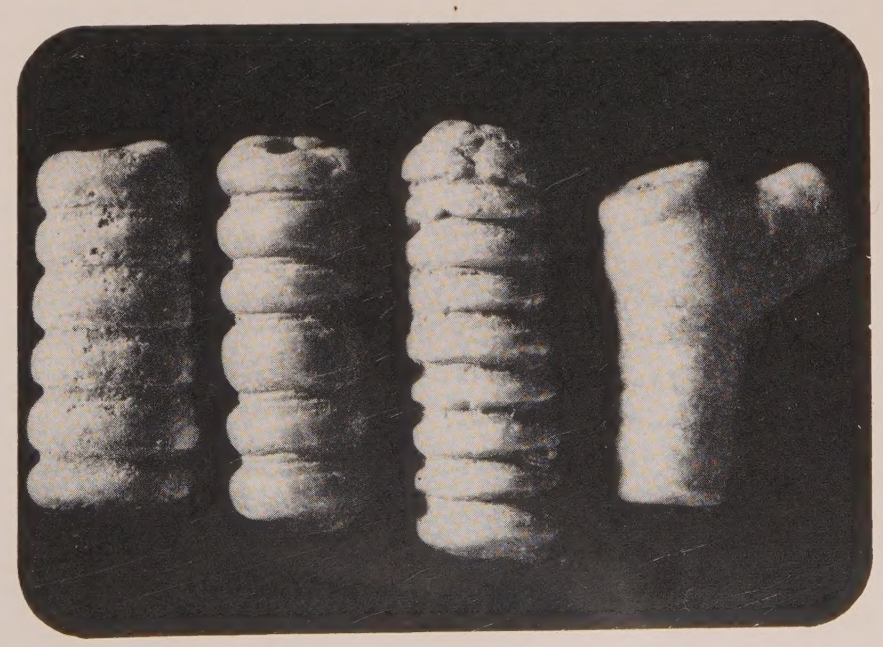
By
C. R. WYLIE, JR.

rocks and in almost all fine gravel. It is to these disc-shaped segments, ranging from one thirty-second of an inch to perhaps an inch in diameter, usually round or pentagonal in outline, and marked with various interesting designs, that folklore has given such poetic names as clock wheels, wheel stones, fairy stones, giant's tears, and rosary beads.

For a long time scientists knew no more about these little stones than did the laymen whose superstitions gave them their many names. No less a person than Georg Agricola, the "father of mineralogy" regarded them as "inorganic infiltrations" like stalactites. Others thought they were the vertebral joints of fishes, or sections of the stems of plants. However, they have been correctly recognized for at least a century and a half as appendages of animals akin to starfish, and numerous scholarly treatises have been written on the classification of the interesting fossil crinoids.

The accompanying photographs, taken at magnifications of from a little more than five to eight diameters, illustrate typical cross-sections from among the thousands I have gathered, chiefly along the northern shore of Lake Erie. The circular outline is found more frequently than the angular, probably because it occurred more frequently in the living organism, although the agencies that weathered the specimens loose from the imbedding rock may at the same time have obliterated the angular characteristics. There is generally a hole in the center of each segment through which passed the alimentary canal of the living animal. In the majority of cases the surface is covered with numerous radial grooves extending nearly to the perimeter.

It cannot be said of these little fossils that, like snowflakes, no two ever exhibit the same design. However, there is a sufficient variety of types to make collecting an interesting hobby, and an important one, too, for the nature of the cross-sections is in many cases significant in the scientific classification of these pre-historic animals.



SOMETIMES YOU FIND THESE

This group shows stem sections containing more than one segment. Specimens found in this relatively complete form are not so frequently discovered by the crinoid hunter, and are, therefore, likely to be considered as prizes in the collection. Whole specimens are, of course, even more unusual and highly-prized. In the specimen at the right is shown the manner in which the stem is sometimes found to branch. These ancient marine animals seem in many ways to lend themselves to the use of terms common to the gardener

AN INQUISITIVE YOUNGSTER

Sometimes only one, at other times more, would appear at the den entrance, curious about what was going on. The mother rock-squirrel, *Citellus variegatus*, seemed to disapprove such temerity

Dweller of the Arid Mountains

Elusive but courageous is the rock-squirrel

By LEE R. DICE

Photographs by Elizabeth J. Dice

THE rock-squirrel, a large species of ground-squirrel, is found in suitable habitats over much of the arid southwest; on the whole it is well-named, for it usually chooses rocky situations for its dens. It is one of the characteristic animals of the isolated rocky mountains of our southwestern deserts. More rarely it ranges out on the desert plain away from rocks, usually where the presence of underground water has allowed cottonwoods, mesquites, or other trees to grow. In the better watered belts of the higher mountains the species is not so closely dependent on rocks, but even here it prefers to make its home in rock piles or around logs.

Rock-squirrels ranged all over the small valley of the Rio Bonito, where we camped in July. They ranged mostly among the rocks on the adjacent slopes. The forest on the steep mountain slopes here is dominated by junipers and pinyon pines, the seeds important sources of food for the animals. Along the stream the walnut is the most important tree, and the seeds of this also are eaten.

The den sheltering the young that were photographed was located in a rock embankment made to confine the river to its channel. The elevation at this place is about 5900 feet above sea-level, but elsewhere in the adjacent Capitan, Sierra Blanca, and Sacramento Mountains of southern New Mexico I have noted the species ranging upward to the lower edge of the yellow pine belt, at some places nearly to an elevation of nine thousand feet.

So far as we could determine there were five half-grown rock-squirrels in the family that we studied near our camp. The mother was living with her babies, but the father was not seen. It is the custom with squirrels in general that the fathers do not associate with the females after the mating season is past, and take no part in the care of the family.

The young rock-squirrels were much interested in the big world on which their eyes had only recently opened. Although they were quite timid they insisted on coming outside the entrance of their den to watch the strange behavior of their human neighbors. Sometimes only a single one would be out in the bright sunshine watching us, but frequently two or three would be out at one time, in spite of the warning calls of their anxious mother. A number of photographs were made at a distance less than ten feet.

The mother never allowed herself to be seen at her den when a person was near, and she evidently strongly disapproved of the foolhardiness of her offspring. The day after a number of photographs had been taken at the den she moved all the young to a new spot a long distance away. We never did find the new home although we frequently heard the sharp ventriloquistic whistle of a rock-squirrel, which we presumed to be the old mother.

The fully-grown animal is about as large in body size as the eastern fox-squirrel, but its tail is much shorter. Perhaps the moderately short tail of the rock-squirrel is

correlated with its essentially terrestrial habits. It does climb trees, but rather clumsily, and it is by no means as much at home when off the ground as are its relatives of the trees.

The burrows of the rock-squirrel usually are made under some large boulder, or under the roots of an oak or juniper tree. However, if no such protected situation is available, the burrow may be located in the open. There are usually several openings, so that the animal may escape by the back or side door if a snake, weasel, or other enemy enters by the front door. Considerable quantities of earth, often including good-sized rocks, are thrown out around the openings to the burrows. Dr. E. A. Mearns, the eminent naturalist, noted one burrow from which the quantity of earth thrown out would have been sufficient to fill a flour barrel.

The range of the rock-squirrel extends from Colorado and Utah far southwestward into Mexico. A number of races have been described, most of them based on variations in the shade of fur color. The pelage color of the species, like that of other small mammals, tends to match more or less closely the general color of the rocks on which it lives. On black lava rocks it tends to blackish; on pale-colored soils lighter colors prevail. This correlation, however, is not an exact one, especially in regions where both dark-colored and pale-colored rocks occur.

DRESSED FOR ITS HABITAT

The spotted coat of the rock-squirrel blends with the surrounding rocks and is a source of protection to the rodent in its native habitat

The lens of the eye of the rock-squirrel is strongly colored with a yellowish pigment. This yellowish lens probably has the same effect as the yellow-tinted glasses that humans sometimes wear, and enables the animal to see better in the intensely bright light of its habitat. The flying-squirrel, which is active only at night, has, on the contrary, a clear lens, without any color.

Rock-squirrels seem actually to enjoy the hot sun of the southwestern arid regions and they frequently are observed sunning themselves on rocks and on logs, or, more rarely, in a scrub-oak. Sometimes they will sit or lie for a half hour or more with hardly a movement. During the hottest part of the summer, however, they usually retire to their burrows during the middle of the day, although there is seldom an hour of daylight when some may not be seen.

Possibly two litters per year are raised in the southern parts of the range of the animal, where the seasons are long. This, however, has not been proved and possibly the young animals that appear late in the summer are from delayed matings, rather than the product of a second mating. In the mountains there is almost certainly but one litter per year.

In the colder parts of its range, in the higher mountains, the rock-squirrel spends part of the winter in hibernation, snugly curled up in its den. In the deserts of the southwest, where the winters are not very cold, it remains active throughout the year.

In disposition the adult rock-squirrel is fierce, although it is also wary. An adult will always retire to his den, or to some other hiding place, whenever a person approaches at all closely. However, when no one is about they will enter camps and carry off the leavings from the camp table, or even raid unprotected food supplies. When trapped, the animals fight vigorously, and such is their strength and determination that they often wreck livetraps in which they have been taken.

It seems impossible to tame a rock-squirrel even if it is taken when very young. Old animals are always ready to attack when their cage door is opened to supply food or water. Nevertheless, when a person approaches a cage, the rock-squirrel will always hide if possible, giving first the shrill but musical whistle of alarm. Their teeth are strong and sharp and they can inflict a serious bite. Several have escaped from my cages by gnawing through the thick boards forming the structure.

The rock-squirrel has its own personal troubles, for each animal usually harbors a considerable population of fleas, in addition to some internal parasites.

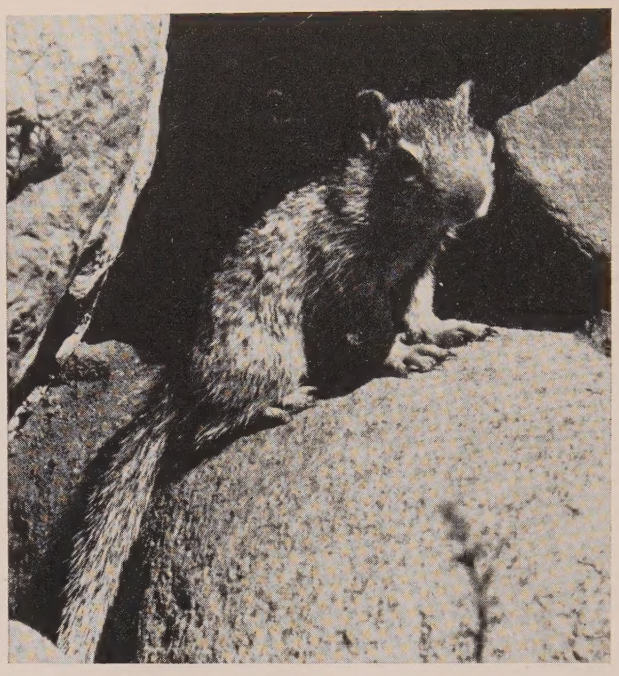
In food habits the rock-squirrel is rather omnivorous, although vegetable matter probably makes up the greater portion of its diet. Carrion is not refused. In some mountain districts the species has the bad reputation of digging into graves.

The rock-squirrel, like the chipmunk and the other members of the ground-squirrel group, has pockets in its cheeks, with openings inside the mouth. These pockets enable the animal to carry away a quantity of small seeds or other food not needed for immediate consumption. In this character the rock-squirrel differs from the tree squirrels, none of which have cheek pouches.

In the more desert parts of its range the rock-squirrel has little economic importance, because of the general absence of agricultural developments. In the small, fertile desert valleys and in the agricultural areas of the higher elevations, however, it often becomes destructive. Not only does it dig up and eat planted seeds and destroy growing crops of maize, grain, and other vegetables, but it often invades stored food supplies. In such situations the early native inhabitants had to protect their winter stores of maize.

In agricultural districts it is often necessary to control the numbers of this animal by means of poison or traps. In most parts of its range, however, the animal comes little into contact with man. Coyotes, foxes, and also hawks and other predators undoubtedly kill many, but it usually escapes the owls by being abroad only in the daylight hours, when the owls are inactive. The snakes, especially the rattlesnakes, undoubtedly feed upon the young, and perhaps the larger snakes may be able to swallow a mature squirrel.

Unless the development of the southwestern arid regions is too rapid, the rock-squirrels living on most of the rocky, isolated mountains can expect, for many generations to come, both to fail to fatten on any of man's crops and to remain unmolested by poison campaigns against them.



ITS TAIL IS OF MODERATE LENGTH

In body size the rock-squirrel compares with the fox-squirrel but its tail is much shorter

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A Friendly Robin

By ROBERT A. NICHOLS, III

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I HAVE SEEN the flaming beauty of the cardinal in the wood. I have heard the wood thrush chant his golden song. I have watched the oriole build his swinging nest, but none of these experiences has afforded half as much pleasure as the friendship I made with a cheerful little robin in my own back yard.

One warm July afternoon, when I was working in my garden, I noticed a robin searching frantically in the parched earth for something to eat. Coming to his aid I dug in moist sections and was rewarded with choice insect delicacies that I threw to the robin, who quickly seized them, packed his beak to capacity, flew away to his nest, and returned in a few minutes, looking for more. The next day I repeated the same procedure, bringing the bird closer to me and lending encouragement with a few whistled notes for every piece of food. The following day, after having renewed relations, I finally persuaded a hesitant bird to take a juicy ground beetle from my hand.

The next evening, I sat on my back porch and whistled for my friend, who came flitting across neighboring fences to the supper call. This time, I held my hand on my leg with choice morsels of living food. The much agitated robin flew back and forth on surrounding branches surveying the situation before he finally alighted on my shoe, picked up courage and advanced up to the knee, and slowly made his way towards the hand of plenty; then making a quick peck, he seized a beetle grub and flew to the fence. After having placed this in the back part of his beak, he came back for more, stuffing his mouth for the young gormandizers of the nest who never seem satisfied.

The following day, the bird performed for my sister who snapped the picture. Strangely enough, he performed as well with me in Sunday attire as in soiled working clothes. After that, my feathered pal and I worked in the garden together, he aiding in ridding my garden of insect enemies. At the end of the summer, I left for college and he left for the South without even a hand-shake.

One of my professors, who is an authority on birds, marvelled that I was able to obtain such friendship in three days from an adult bird, especially when it was nesting.

TIME MARCHES BACK

By MABEL GILLESPIE

Illustrated by R. Bruce Horsfall

"THE MANTIS WENT CLIMBING UP THE WIRE . . . AND THEN OVER THE TOP, HANGING UPSIDE DOWN BY ITS LEGS."

NO ONE would ever have guessed that out of an innocent looking wren box could come a chapter of prehistoric struggle between two beasts of antediluvian appearance. After the wrens signed out in late summer, we took down the box to clean it out as usual. The apartment, however, was sublet, quite unknown to the wrens or to ourselves; and the secret tenant, terrified at the thought of discovery, attempted to escape. Out of the entrance hole, no larger than a quarter of a dollar, leaped a mother mouse with five babies clinging tightly to her teats. She did not lose any of them during her exit, but their presence put brakes on her speed and we managed to capture her, babies and all.

At that moment there was no whisper of pterodactylian echoes. Here were mice, no more, no less. If we executed them there would be six less nuisances to raid the pantry. And yet—they weren't dirty-brown house mice, but sleek, soft-gray deer mice with white feet, like dainty mice-in-boots. Furthermore, we were psychologically ready for some novel experiment or new adventure. So we kept the wee, clinging family, little dreaming what fantastic scenes, like shadows of a wild and monstrous past, we should eventually witness in the arena of the mouse cage.

The cage was prepared from a packing box from which one side and the top had been removed. Half-inch cellar-window wire covered the entire box, for the mice not only could, but did gnaw considerable portions of the wooden walls. When the babies were older we put in ladders, inclined runways and trapeze swings. We were determined to provide all the requirements of an up-to-date nursery.

It was some days before the infants willingly relaxed their hold on the mother. Once, before the cage was completed, the mother escaped and leaped or fell from a table to the floor three feet below. She landed squarely on top of the babies who still held on tightly, and none seemed to have been at all damaged by this experience. The mother made a nest of the cotton and excelsior that we placed in the cage, and within this retreat the family was lost to view most of the time, although the downy mound often heaved and swayed from their movements. Yet there must have been times when the babies all went to sleep, for at intervals, usually at night, the mother emerged without encumbrances to look for food.

We took the problem of food seriously. Of course there were always bread and cheese, apples and nuts to fall back on. But we felt bound to raise these babies according to the latest theories, which involved providing the necessary vitamins. To this end we were persuaded that the mother needed "good red meat" according to her usual fare, and so we enlisted the youth of the neighborhood in a hunt for grasshoppers and other appetizing morsels. Paradoxically, it was through this attempt to keep up with the times that we unconsciously set the stage for the Carboniferous combat.

It was the Oriental praying mantis that finally turned back the hands of time several hundred millenia. I encountered one while pursuing insectivorous game. Of course the mantis is an insect too, although certainly an enlarged caricature of a respectable insect. It seems to have a long neck with a funny head that cocks itself on one side with great, bulging eyes staring at you, and two antennae quite like wicked horns. The first of the three pair of legs are stout with file-like edges. When they are folded against the body the insect is supposed to be in a prayerful attitude. It all depends, however, on your idea of prayer. I am reminded of quite the opposite attitude, particularly when the weird thing turns its head and looks at me over what isn't its shoulder.

As always, when I come unexpectedly upon this incredible insect, I felt like the small boy who saw a giraffe

for the first time, gazed thoughtfully for a time and then rendered the verdict that "there ain't no such animal." In like manner the mantis has an aura of unreality, suggesting a nightmare fantasy and at the same time assuming attitudes and expressions that are reminiscent of peculiar persons one has known.

"THEY CLINCHED AND FELL TO THE FLOOR OF THE CAGE"

When I pounced upon this unreal thing, getting scratched with its leg files, I had no notion that I was providing the last element needed for a pre-glacial drama. I thought only that it would be an interesting experiment to see what Mrs. Mouse would do when confronted with a life-sized meal. She made short work of the ordinary insect, leaving only a pathetic pile of wings and legs when through her feast. But the adult mantis is four or five inches long, and therefore is "taller" than a mouse. With all four wings spread it covers an amazing amount of space. Our mouse, on the other hand, had it all over the mantis in the matter of weight. The odds seemed fairly well balanced.

It seemed wise to try the experiment at night, for then the mother mouse was better able to get away from her clinging charges, and it wouldn't have been fair for her to have been unnecessarily handicapped. The mouse cage was kept on an unlighted porch, so illumination was furnished by electric torches aimed at the arena like flood lights. In this artificial light the clumps of tansy weeds we had placed in the cage to simulate natural habitat assumed the aspect of giant cycads casting weird, massive shadows behind them. It was as if we shrank in size, or the arena grew larger and larger until its tree-ferns towered toward the sky, trailing black feathery shadows.

Admitting the praying mantis into the forest of tansy-cycads released further magic. In a flash time and distance both receded. The scene was of a time far away and long ago, and its proportions were now gigantic and primeval. The praying mantis was forgotten and in its place we saw something that looked like a pterodactyl—an immense, dragon-like monster with great wings that has been in Valhalla for millions of years. The terrifying thing prowled about in a shiveringly sinister manner, with all the appearance of looking for trouble.

Then something stirred in a dark and distant corner where the shadows of the cycads were deepest. The magic had fallen on our mouse and turned it into a mammoth-like creature, so that even its quick movements seemed tempered to a lumbering cumbersomeness. As the mastodon plodded deliberately forward, terrifying echoes of the Jurassic or Pliocene seemed to reverberate in distant caverns of dark memory, and we felt the burden of the deadly and desperate necessity to struggle for existence.

Then the god of comedy cast a spell of anachronism across the arena so that we found ourselves, even while shivering with primitive and instinctive premonition, interpreting the combat in terms of a modern prize fight. At first the two combatants faced each other and the mouse biffed the mantis with a quick, cautious thrust, but the mantis side-swiped her and scratched her with the file-like edge of a fore leg. The mouse retreated to a corner in the manner of a sulking Achilles. But soon she was back again and the encounter was repeated. This continued for some time. After a particularly vicious jab from the mantis, the mouse would retire to the seclusion of her nest, there presumably to brood over the insult. But the lure of the quarry was too much for her, and she always came back. Sometimes in the intervals between rounds she would grab a cricket or locust or whatever happened to be about, and hastily devour it as if seeking more strength for the combat, like Popeye with his spinach.

Always, as we watched the creatures leaping at or dodging each other, great shadows moved behind them. It occurred to us that there had been times uncounted in long forgotten eras when the moon had caused gigantic shadows to maneuver across the mysterious jungles that harbored myriads of desperate duels.

Finally the mantis went climbing up the wire across the open side of the cage and then over the top, hanging upside down by its legs. The mouse ran up a tansy stalk, shaking the foundations of the magic that gripped us, for we realized that no mastodon could ever have climbed a cycad. She poised for a second and then leaped for the mantis. They clinched and fell to the floor of the cage. Before the mantis could deliver a good right scratch to the jaw, the mouse bit off its head and it was all over but the eating. The favorite had won, and how she mopped up the remains!

Night after night we staged an encore, and never did its evolutionary echoes fail to send a thrill along the spine. We lured neighbors from movies, and treated friends to an entertainment they despaired of matching. If it had not been that the supply of mantes failed with the coming of frost, our show might have rivalled a Broadway favorite in endurance.

After such superlative spectacles the chronicles of the

mouse family coast rapidly down-hill to a sad anti-climax. We kept them for some six months after the mantis crop failed. The babies grew up and one of them was eaten by the other four during their adolescent days. They all escaped and for days we dared not set a mouse-trap lest we murder one of our pets. The house swarmed with fearless rodents until we evolved a harmless method of capturing the fleet-footed little gliders. On their acrobatic apparatus they rivalled the daring young man on the flying trapeze, and they had friendly moments when they would nibble sunflower seeds from our fingers. But all this, though sufficiently entertaining, was definitely of the twentieth century, and the spell of ancient eons had vanished.

When the flowers began to bloom spring fever must have been too much for the mice, for one by one they managed a second and final escape. It is more than likely that each promptly fell prey to some hawk or owl, for the struggle for existence continues, although it may seem less lurid and startling. Perhaps one survived, herself to establish a home and family. And for all any of us will ever know, she may have met a praying mantis by moonlight under the tansy leaves, and repeated the struggle which thrilled us so, and yet which is so old to the moon.

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The Elusive Henslow Sparrow *By* ROBERT F. McDERMOTT

How many of us pass right by numerous birds with secretive habits, during our tramps through woods and fields, without sensing their presence?

The Henslow sparrow is one of the common sparrows that may be easily overlooked, because of its seclusive habits. It will flush only when disturbed, and its flight is so brief that it disappears in the high meadow grass almost before you are aware that the bird is in the air.

NEST AND EGGS OF THE HENSLOW SPARROW
Three days of search were spent before finding it closely concealed by the broom sedge and grasses

Once familiar with its call—a shrill, chi-lick! chi-lick! chi-lick!—you cannot mistake it, and you will be surprised at the number of fields and meadows of your acquaintance that shelter these feathered friends with terrestrial habits. If you hope to observe these sparrows in domestic situations, you must prepare for an arduous day in the field, and a good part of it will be spent on your knees. To see and hear the Henslow sparrow is one thing, but to locate its nest is a task that will try the patience of the most ardent enthusiast.

I spent considerable time matching my wits against this impetuous, deceiving mite of a bird, before I succeeded in locating a nest. About the middle of May I set out with William Wimsatt, a friend, to find and photograph a nest in Maryland. Once in a field where we had seen and heard the birds, we flushed several, undoubtedly males, for we were to learn that the female sits tight when incubating. After an hour or so of fruitless, haphazard search, we decided to try another method and started to walk in a line about arms' lengths apart. When we flushed a bird, a hat was dropped and a search was made in the vicinity.

At last we found a nest in the broom sedge—but it was a field sparrow's. The next time that we went to the field, on May 19, we were equipped with a light rope about forty feet long. With one of us at each end we dragged the field. As the light rope brushed the tops of the broom sedge, a Henslow sparrow took wing about six feet ahead of the rope. Dropping the rope we began a systematic search of the immediate area. Around the base of the broom sedge tufts, were many nests of field rats and mice. Their maze of runways between the blades of grass seemed unending. Still we found no trace of the sparrow's nest.

The third bird that we flushed came up almost under the rope. This time we searched behind the rope and found the nest about eight feet back of where she had taken wing. She had travelled mouse-like along the runways all that distance before rising, apparently trying to deceive us.

Beautifully made of coarse grass, and lined with fine grass interspersed with bits of hair, the nest rested almost below the surface of the ground at the base of a large clump of sedge. It contained five grayish-white eggs, a little larger than those of a field sparrow, yet a trifle smaller than the song sparrow's. They were heavily speckled with rufous-brown spots, forming a wreath at the butt and fading out toward the point.

We returned some time later hoping to photograph the fledglings. However, we were disappointed to find that a field rat, or some other relentless, predatory enemy, had left only the broken shells as grim reminders of his raid.

In several recent novels with a Florida background, notably Marjorie Kinnan Rawlings' splendid book, *The Yearling*, there have been frequent references to the "hammock". We knew this did not mean that uncertain and uncomfortable contraption that stretched its befringed length from the oak tree to the nearby maple during our childhood. But we were not quite sure what a Florida hammock really is. Others have, no doubt, wondered also, and Celia Dobrin, in the accompanying article, answers unspoken questions.

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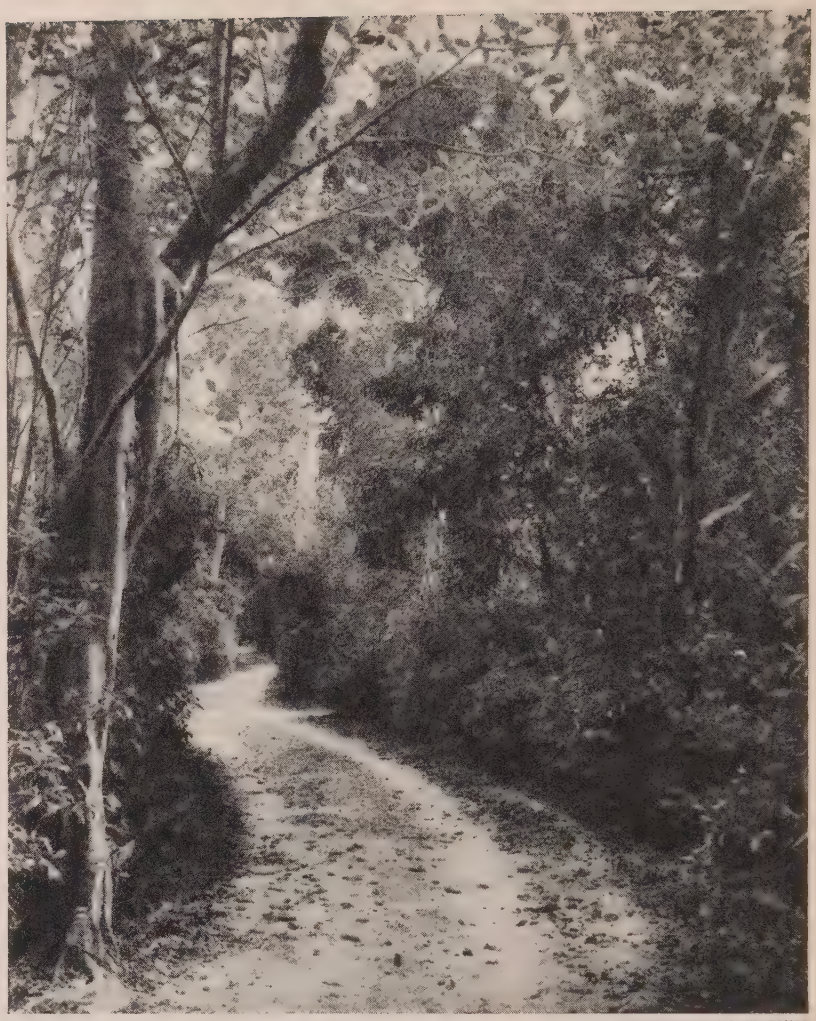
HAMMOCKS

With special reference to the tropical type of South Florida

By CELIA DOBRIN



IN A FAMOUS HAMMOCK

Royal Palm State Park is a large hammock preserving the typical flora of such a growth. Note the strangler fig at the extreme left, well along in its destruction

PHOTOGRAPH BY G. W. ROMER

SOUTH FLORIDA is a wild country and its topography is such that its wildness has been slow to yield to man's encroachments. Near the sea are mangrove swamps; farther inland are flat fields of coral-colored Natal grass in which grow palmettos and pines. Then come the everglades with their miles of saw-grass, open water and cypress islands. Here and there, by streams, ponds, swamps, and bay shores and even along the open sea, occur hammocks, tree growths that figure extensively in descriptive literature, and in the lives of Florida's inhabitants, both wild and human.

Hammock is a term applied by botanists to particular associations of plants that respond to certain conditions of soil and moisture. They are peculiar to our southeast coastal plain, and especially to Florida. Dr. Roland M. Harper, a close student of our southeastern botany and physiography, offers the following brief definition: "Dense growth of trees other than pines in comparatively dry soil (or at least not wet enough to be called a swamp), in a region where open pine forests predominate—an intermediate condition between hammock and swamp is often called low hammock".

Since there are local differences in the causative factors that give rise to hammocks, several types are often distinguished. The type treated in this article is that of southern Florida, where the vegetation has a strong tropical tinge. Royal Palm Hammock, now Royal Palm State Park, is the best known and best protected example of this type.

Since much of the country is underlaid by coral rock and black marl over which lies a rich soil derived from the decay of a luxuriant flora through the centuries, the existing plants are well nourished. The natural result is a continual battle for existence among the hammock plants.

The hammocks of southern Florida support many kinds of hardwoods, and several palms. The first tree to spring up and help form the hammock is the live oak. It is the Achilles of the forest. In the struggle for life it has developed tremendous defenses. Forest fires rarely harm it. It eliminates sunlight by its thick foliage, is free from disease and is troubled by few insects. The next tree to be seen in the embryo hammock is the *Trema floridana.* Then the dwarf sabal grows to the true cabbage palm, and the hammock is begun.

When the hammock is fully grown, there is a dense scrub on its outer border. This usually consists of low-grown live oak, red bay, the common sumac, prickly ash, trema, coral bean tree, and lantanas. The satin-leaf tree, *Chrysophyllum,* with its intense metallic green leaves on whose surface are brownish golden hairs, thrusts its branches out into the sunlit part of the formation. The leaf hairs are close together, and the leaves flash and glow like golden satin when the wind turns them. Grow-

ing near the satin-leaf is the poison-wood tree, *Metopium.* The leaves are dark green and smooth, and on its light brown trunk are spots of brick red, caused by its resinous sap. The spots are round and the size of a grapefruit. The bark is rough, but the spots are very smooth. When the dew settles on the tree it remains there all day. I have heard that the Indians in South Florida believed that if one slept under this tree, and if the dew from the leaves fell on him, he would die.

One of the most interesting trees in the hammock is the paradise tree, *Simarouba glauca.* Dr. Charles Torrey Simpson has written "When I first came to my place twenty-eight years ago I found a considerable number of paradise trees growing in the hammock, mostly quite old and of large size, but during all the years I have lived here not one of them has ever produced a seed or blossomed. But there were many small trees, not any of which were more than a foot in height. These were often in the thickest part of the forest where there was no room and but little light. I noticed that year after year they put on a single pinnate leaf, or at the most a couple, and that they seem perfectly healthy. At first I thought it would only be a matter of a few months when they would die outright, but to my surprise they lived on and at the time of the big tempest (1926 hurricane) not one of them was two feet high, with a trunk of perhaps half inch. . . . But just as soon as the storm wrecked the hammock, these paradise trees woke up and almost over night became entirely different. The small, delicate leaves were dropped and strong lush ones were developed at once. These trees attained a height of about twenty-five feet in a few years."

Among the other trees in the heart of the hammock stands the huge old live oak with its ribbed trunk and gray-green leaves. Near it grows the gumbo limbo, *Bursera simaruba,* with shining red bark that resembles the skin of a snake. The trunk is long and round, the branches jut out from the top of the tree, and there is nothing for about eight feet but bark. Beside it grows the small wild tamarind tree, *Lysiloma bahamensis,* with sweetly-perfumed white and red-blended flowers. The seed looks like the locust seed. In the vicinity of the hammock, also, is the iron-wood, *Eugenia confusa,* which is an enchanting tree belonging to the myrtle family, and seen only in hammock-land. For a small tree it grows rather high. The leaves are tiny, pale-green and round, and are formed together in a flower-like bunch on little crooked branches. The tree itself is a crooked stick and the effect is picturesque.

The hammock is a dark place; and those plants growing next to the ground are those that like the shade. The Boston fern, *Nephrolepis,* on the cabbage palmetto, can be viewed here and there in the nooks. The wild coffee plant, *Psychotria,* is particularly adapted to the shade of the hammock. Along the paths of the forest it thrives and has a small berry throughout the year. The wild coffee looks like a bush but it is really a tree. The bushes in a hammock near my home are about five feet high and have not changed much in height for the past five years.

Air plants developed in tropical forests because of the intense struggle for space, light, air and food. Gradually adapting themselves to drawing sustenance from the air, their roots became mainly means of holding to the trees on which they grow. These find their place in the flora of the hammock.

There are various plants which, in the struggle for existence, need sunlight. Those plants, when they were shaded by the strong trees in the hammock, sought a way to the sun. They developed tendrils, claws, sticking disks, adhesive hairs, prickles, and even spines, in order to get to the sunlight by climbing other trees. The strangest of these is the strangler fig, a member of the rubber family. The seeds are carried by birds, which drop them in some crevice or trunk of a tree. First, the fig drops aerial roots that wind about the trunk as they grow downward to the ground, where they take root. Then they grow in size and twist around the tree, strangling it. A full-grown strangler fig looks like a huge boa constrictor wrapped around the tree. When the dead tree no longer sends out leaves the strangler is master.

The denizens of the hammock live and die in a battle for supremacy. Many old live oaks, ironically, are killed by the strangler fig, native only to hammocks. Here wild life and natural beauty are preserved. Birds, insects, snakes, tree snails and other groups live in a habitat where tropic vegetation affords them a home—if they fight for it.

There are a number of hammocks in south Florida that have been set aside as wildlife preserves. Chief among these is the Royal Palm State Park, a large reservation that amply rewards the many visitors who visit it each year.

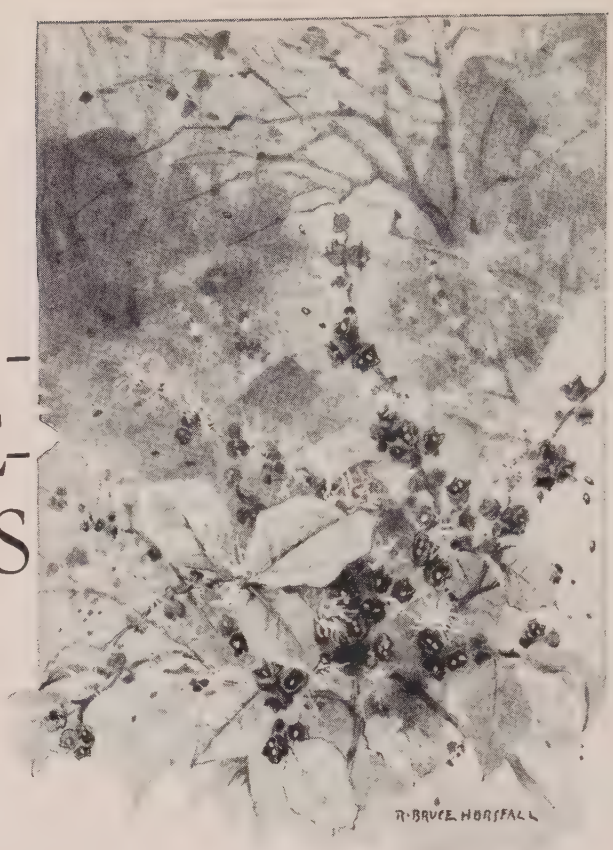
Migrants

By MATTIE HALLAM LACY

O, brave sea-swallows, scorning night,
  Spurners of shadows, winging
Determined strokes upon your way
To the far edge of lengthened day,
  Your lode-star light for singing.
Mark well your sky-road in your flight,
God rest your wings and keep them white.

We who have met frustration's bar,
  Whose days are shadow-haunted,
Wish you Godspeed and courage when
The light you find fades out again,
  Courage of faith undaunted.
How well we know the luring star
By which you steer is far . . . is far!

WITCH-OF-THE-WOODS



By IDA McCLATCHIE

Illustrated by
R. Bruce Horsfall

SCIENCE has ruthlessly stripped from the witch-of-the-woods such supernatural power as she was once believed to possess. A forked witch-hazel branch, we are told, will not locate wells of living water beneath the earth's surface. Nor is the witch-hazel extract of commerce held possessed of medicinal virtue. There are even those who will tell you that the properties and powers ascribed to her have sprung entirely from her modern name, and this, by the way, is derived from a Saxon word that does not mean witch at all.

Yet I like to think of witch hazel as a true witch—but without evil attributes—in the marvelous laboratory of leaves and stems. I like to think of it as possessing magic power. It is, at least, a fact that the witch-hazel's unusual time of flowering does cast a bewitching influence over the mind of the Nature lover. He cannot but wonder why she chooses the chill and windy season of late fall to deck herself in the frail habiliments of summer. There is witchery in this, to be sure. For when the months of bloom, a bright-robed, lovely procession, are only a delightful memory; when autumn's glory is dimmed and most deciduous trees lift bare arms to cold skies; while many shrubs stand stark and forlorn and her own leaves are falling, then witch hazel breaks into a golden shower of bloom.

Having thus clothed herself in spring-like beauty, she rests until spring, when her seeds begin to develop, her leaves unfold and her flower buds, ready for another late autumn's bloom, form in their axils. By late June they may be found as small, cream-colored projections. By the middle of July they are round, brownish buds beside the new leaf buds that are already formed for another spring's unfolding, and for another cycle in witch hazel's odd plan.

So it is that when the woods are again bare and gray we find her dressed in flowery brightness. Although the flowers are small their cheerful yellow color enlivens the general somberness. As the buds open, displaying their golden treasure, the four long, narrow, strap-like petals unroll and come out much crumpled. They never entirely lose that crumpled appearance, but always look a little as if they needed pressing. The flowers are disposed in small, three to four flowered, short-stalked clusters, the flowers being sessile on the stalk, or pendule.

No fragrance exhales from them in the chill air, for every winged creature that plundered the summer flowers of their nectar and pollen has either gone into hibernation, wrapped itself in a cocoon coat, or slumbers deeply in a chrysalis. There is nothing to attract save the November wind, who, with his rough caress, will perform what cross pollination is done. We know some must be done, although the four stamens are not as long as is usual in wind-pollinated flowers. Not all the flowers are perfect —having both stamens and pistils—a few plants being polygamous, that is, bearing perfect, pistillate and staminate flowers. But of wind there is an abundance at this season, as anyone who has attempted to photograph the flowering plant has learned.

Nor is there any bird song now to fill the woods with colorful sound, except the occasional whistle of the cardinal or the autumn notes of a robin who has decided to winter in the north. And sometimes, in an afternoon, high overhead, wild geese move southward, in a long, undulating line, dropping triumphant, heart-stirring cries as they pass on into the dim distance as they wing southward.

Now, at the time of blooming, witch hazel's woody seed pods, which normally hold two hard, shiny black seeds, only now ripe, are opening. Thus she has earned the name, *Hamamelis,* meaning flowers and fruit at the same time. Here are loosened yellow leaves, ripening seed and opening flowers all on the same branch. Is not this enough to intrigue the fancy?

Her seed children cannot adventure far, as can those more fortunate ones who are born, as it were, with silver spoons in their mouths; that is to say, with silken parachutes or wings, as are the seed children of the dandelion and maple. But this plant mother gives them the best start in life she can. The opening of the seed pod is performed with an explosive movement that scatters the seed several feet from the parent plant, thus bettering their opportunity to obtain growing room.

It was one of the October pleasures of my girlhood to bring sprays of witch hazel from wood borders to place in my bedroom. In the greater indoor warmth and dryness the pods would soon open. Often as I lay in bed in the darkness, the stillness would suddenly be broken by a sharp snap, and I would know that a witch-hazel seed had been forcefully shot against one of the walls.

The witch hazel is not restricted to our northern states but is found from Nova Scotia to Florida and from Minnesota to Louisiana. In the northern states it is never more than a tall shrub, but on the mountains of the southeast is said to attain to the height of a small tree. Its usual time of bloom in the north is late October and early November. But a few buds are often left on the branches and will open during mild spells throughout the winter. The flowers of these are usually smaller than those that open in the autumn.

The witch-hazel family (Hamamelidaceae) of our eastern states is a small one, consisting of only three members—the beautiful sweet gum tree, or *Liquidambar styraciflua,* being the most distinguished. Yet this is no better known and loved than the more lowly witch-of-the-woods.

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Checking Up on a Spider

By VERNON S. PAYTON

WORKING on the night shift in my garden last summer, a spider provided me with some entertaining hours of observation, an interesting photographic opportunity and some lessons in industry. More than one hundred pictures were taken, the two here showing the full web completed for the night, and a web built the night before being dismantled. Timing the spider, I found that it takes this one-and-one-quarter-inch spider about one hour to build its four-foot web. The job of wrecking an old web averaged one-half hour. The photographs had to be taken with photo-flash bulbs because when floodlights were tried the spider promptly dropped to the ground to escape the nocturnal sunlight. The webs were not sprayed or treated in any way before the photographs were taken.

The Green Tree Boa

By ARTHUR H. FISHER

THERE are many species of snakes that are both beautiful in color and design, particularly among the boas. An outstanding example is the green tree boa from Brazil, which attains a length of about eight feet and wears the most glorious and vibrant greens of the tropical forests. Also outstanding is the fact that this species seems to enjoy using its beauty of color and chain-like markings to assume effective attitudes. The pose shown here is not just a "lucky shot". This boa almost invariably drapes its body on a limb with an apparent definite idea of symmetrical effect. Snakes never assume awkward positions, whether active or at rest, but, artistically, the green tree boa seems unique.

Baby Whitecoat

By EDITH M. LAING

PICTURED on this stamp of Newfoundland is a northern seal pup. Seals comprise the family *Phocidae* of the order *Pinnipedia,* meaning fin-footed. They differ from their cousins, the sea lions, in having no external ear; so when you see the remarkable performing seals in zoo or circus you will notice they are not seals at all, but sea lions. They probably will have come from the California coast. The so-called fur seals of the north Pacific are also sea lions.

Seals of the North Atlantic are of several species, some frequenting the western shores and others the eastern. In spring and early summer the great sealing fleet from St. Johns, Newfoundland, hunts the herds to be found on the drift ice coming down from the Arctic. Spotting of the herds along the coast of Newfoundland and Labrador is now done by airplane. Sealing is a hazardous calling, for the men must traverse the floating ice. Skins and blubber are removed on the ice.

The seals in general are known to the men as "swiles". The most valuable species is the Greenland seal, commonly called a harp seal. The young are covered with long, white, woolly hair. In six months this coat has changed to bluish-gray, and at maturity has acquired peculiar dark markings which suggest the shape of a harp.

Found with the harp is the hooded seal, a larger species. The male hood has a sac of skin on top of his nose. He inflates this into a strange hairy balloon above his whiskers.

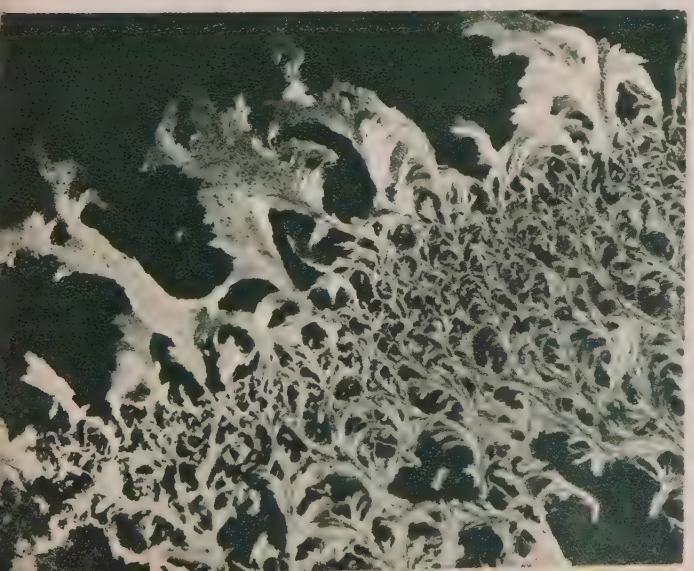
The mother seals teach the young to swim, and when stormy waves break over the nursery rocks or ice floes, they protect the helpless pups with their own great bodies.

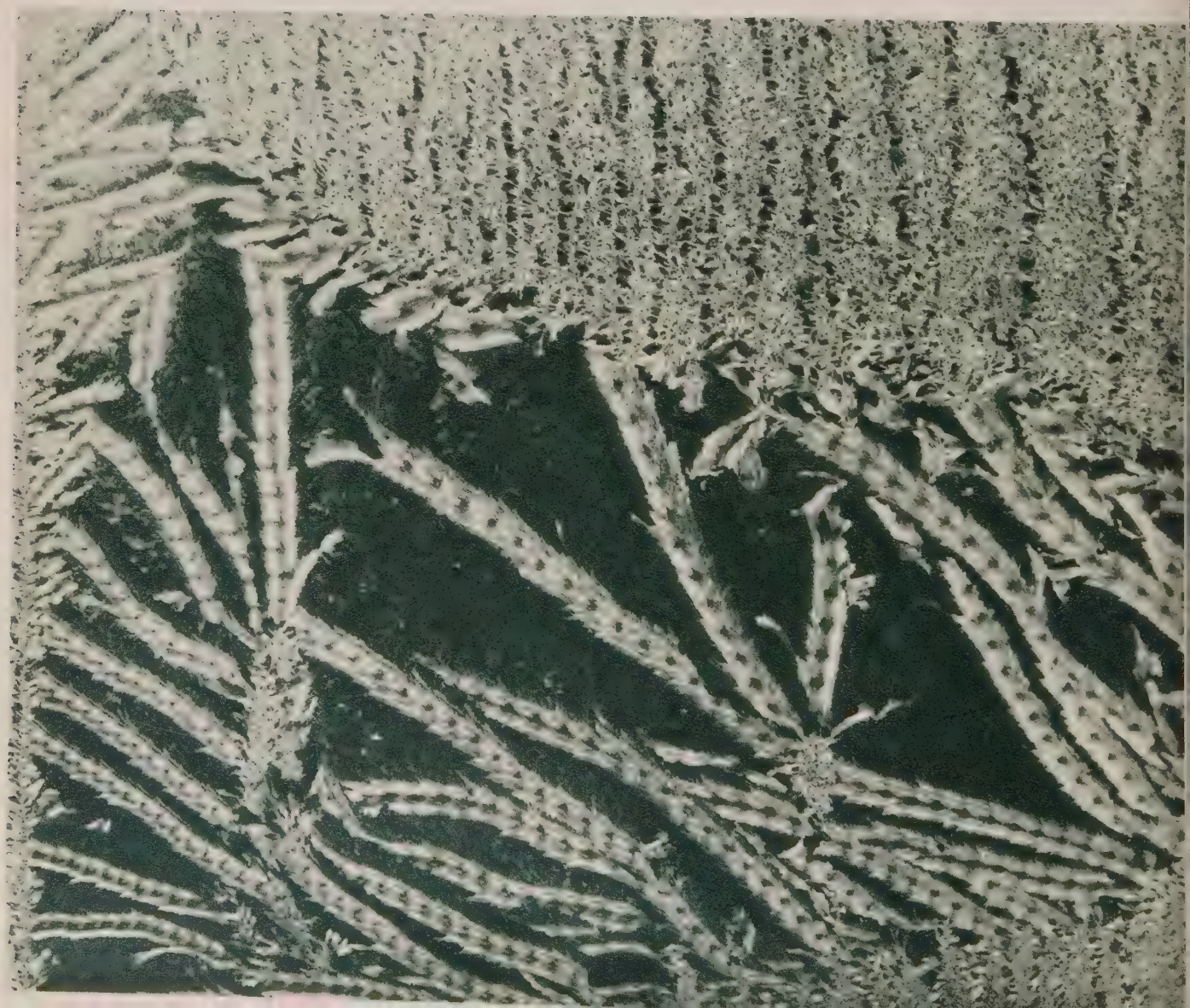
Seals feed on fishes, crustaceans, and mollusks. To the Eskimos they are invaluable for meat, blubber, skins, and other purposes. The polar bear hunts them for food, and the civilized world hunts them for oil and hides. While the hides are fine for moccasins and fishermen's boots, women's coats made from the dressed skins are not at all attractive.

FROST ON THE WINDOW PANE

Frost, broadly defined, is anything caused by a freezing temperature. What we call "cold spells" have been described in English literature as "great frosts". Frost has been personified: Jack Frost, who hardens the ground and closes the streams, is also the artist of the window pane. His pigments are crystals and his designs infinite. This is hoarfrost, and on this and the next two pages we find examples of this wintry art as recorded by Dr. Lester W. Sharp of Cornell University.

Wintering where there is ample opportunity to study the subject, Dr. Sharp has made it a hobby. All of his pictures, of which these here reproduced are a few, were taken of formations on the inner surface of storm windows on a house having humidified air. The photographs were





taken from the inside directly against the daylight. The camera was equipped with extension bellows and a 7½ inch objective. Slow lantern-slide plates were exposed for a few seconds at f.16 or f.22 and developed with strong hydroquinone. The backgrounds were merely neighboring dark houses, the sky, or the snow-covered ground.

The details of a formation on a window pane may resemble the one melted away by the sun the day before, or it may be entirely different. Never, however, is the frost pattern exactly the same. Such variety leads one to wonder what may be the factors that determine the design that appears, and why so often the formations follow, in a general way, growth forms in plants. Whatever may be the obscure reasons behind them, these examples of Jack Frost's ingenuity deserve to be admired for their own peculiar beauties.

Other forms of hoarfrost are, of course, equally beautiful, particularly those gathering upon trees, shrubs, leaves, timbers and elsewhere. A frost also has economic importance in what it may mean to the farmer and orchardist. Coming when fruit is formed on the trees, or too late in the blossoming season, it can be heavily costly to an orchard crop. Nevertheless, it may also serve to prune a tree, since all blossoms do not appear at the same time, and not all blooms on one tree are affected by a frost. Man, however, has learned to anticipate a frost and to mitigate its damage by orchard heaters, and by protecting low-growing vegetation.

Frost also serves by freezing in crevices of rock, thus aiding their disintegration into eventual soil; and by loosening the soil. It is, of course, a part of Nature's plan in these respects. It does seem, however, that with frost—and its close relative, snow—Nature is in a gentler mood, playing with dainty crystals; showing her versatility; challenging man to equal her in creating such beauty.

LIFE WITH "BUDDY"

By GERTRUDE V. GROVER

Photographs by Hildreth Hawes

"Buddy" is a cedar waxwing. He came to us on a bitter morning in mid-November. The previous evening he had been picked up on the running-board of an automobile, screaming with fear and with a broken wing. He was nearly famished for water, and had not eaten for at least fifteen hours. As waxwings are fruit eaters, Buddy scorned the seeds we were feeding the birds outside, but fortunately berries were still clinging to a buckthorn and high-bush cranberry, so he was temporarily supplied. In the meantime we experimented with a wide variety of foods, and his "de luxe" diet was finally established by process of elimination.

Dates, grapes, raisins and raw beef cut into small pieces and supplemented with lettuce, doughnut and fine gravel, apparently compose a balanced diet that keeps him healthy and happy, with plumage like satin. During the summer fresh fruits are substituted as much as possible, but he has become so thoroughly domesticated, or perhaps pampered, that he refuses even to peck at a whole strawberry or cherry. They have to be cut in pieces and sprinkled with sugar. He gladly accepts wild red and black cherries, but can not be induced to take choke cherries.

Each morning he comes to an improvised perch at the kitchen window, for orange and bread and honey. Poor "Buddy" had a sad experience with honey. A nurse employed in our household conceived the idea of setting a dish of it in his cage. He evidently mistook it for his bath for he jumped in with both feet, became entangled and had to be rescued. He was properly washed and, lest he take cold from such a drenching, was wrapped in warm towels to dry. This seemed to add insult to injury, and from that day on he never has bathed in his cage. He goes to a dish in a small winter garden, where he takes a bath and sprinkles the ferns at the same time. He shows a decided preference for light-colored foods—

DOMESTIC MAMMALS

By E. LAURENCE PALMER

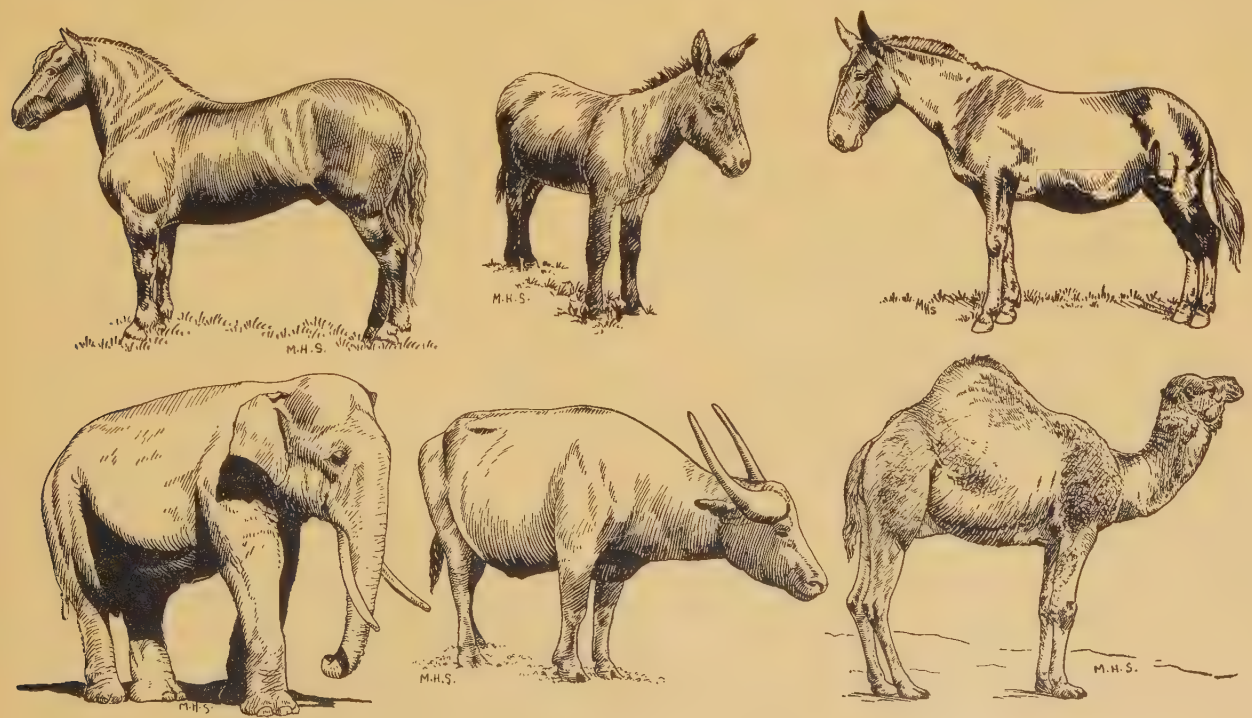
This is the seventh in a series of educational inserts prepared by Dr. Palmer. The next will appear in the February, 1940, issue

"MAN doth not live by bread only". Among other things necessary for a balanced diet and a happy existence are meats, milk, butter, clothing, companionship, relief from too heavy labor, and knowledge and materials for fighting disease. All of these, and more, are supplied by different domestic mammals. It is highly appropriate that one number of this series be concerned with a recognition of the kind of service that different mammals have rendered to man. The merits of certain of these animals have been extolled in *Black Beauty* and *Beautiful Joe*. Ernest Harold Baynes, at the time of his death, was developing a series dealing with unique services of different kinds of mammals to man. Whether we consider the outcast who gets sympathy from his cur dog, the messenger who brings help because of the running ability of his horse, or the doctor who saves thousands of human lives by studying the effect of diseases on white rats, guinea pigs or monkeys, our debt to the faithful domestic animals is great. Many of them have been so bred by man that they could no longer exist independently. They deserve to be better understood.

Domestic Mammals and Labor

Gasoline engines may drive domestic animals from our thoroughfares and from some of our cultivated fields, but as long as man lives many will go afield on horseback and delight in the companionship of the dog. The airplane may soar spectacularly over ice-covered wastes and rocky mountain trails, but dogs will still be used for drawing sledges, and mules and burros will climb the mountains where the modern machines cannot go. Where there is wet soft soil that must be cultivated for the growing of rice the water buffalo will long wallow to his own pleasure and his master's profit. Camels will do much of the work on the drier sandy wastes, as will yaks in the cold mountains of Asia, while in southern Asia elephants will be "pilin' teak in the smudgy squdgy creek" in some places, even though tractors are displacing many of them elsewhere. Equipoise, the horse believed to have run the fastest mile on record, died August 4, 1938, but there is every reason to believe that eventually his record of 1 minute and 34⅖ seconds will be beaten.

It has not been many years since most farms had treadmills on which bulls, horses or large dogs were put to work to supply power for threshing, churning, or other types of farm work. By careful selection, animals superior in the desired qualities to those that preceded them have been produced. America was explored and settled by draft animals, while the ancients who built the pyramids probably used human labor. Even today in the Orient human labor supplies much that elsewhere comes from domestic mammals and machines. No matter how far we may get from these earlier practices, it is probable that much of our lubricating oil and most of the cup greases that keep our machines running efficiently will come from domestic



mammal sources. Leather from the hides of domestic mammals formerly delivered power in most factories. But man himself, through his scientists and engineers, has learned to pass much of the burden from flesh to the inanimate.

Domestic Mammals and the Food Problem

There would be no problem of overproduction of agricultural products if man were compelled to get his whole food supply without any assistance from other animals, including men. The problems of leisure and unemployment would not exist, because everyone would be obliged to labor most of the time and would have no leisure. Had not man used his head to solve his own problems we would have none of the following things:

Jersey cows producing milk of five percent milk fat at 20,616 pounds a year; good average Ayrshire cattle producing 7000 pounds of milk of four percent milk fat a year; Aberdeen Angus cattle, whose carcasses are 65 percent merchantable materials with the fat evenly distributed through the lean; Hereford cattle that can produce valuable flesh on relatively poor forage; Shorthorn cattle whose carcasses and milk production make them among the most popular dual-purpose cattle; breeds of swine that may produce lard, bacon, hams, or all three, economically; sheep whose lambs grow so rapidly that in three or four months they may weigh up to 90 pounds; goats that may produce milk at from two to eight quarts a day with small pasturage requirements; dogs that make it possible for man to herd enormous flocks of sheep and goats with a minimum of labor on his own part. In this, man owes something to his own intelligence in training the dog to help in raising the food supply.

Not so much intelligence has always been shown in the solution of problems associated with man's dealing with members of his own species. We have learned how to raise pigs, but not how to market them with profit to the pig raiser and at a retail price within the reach of many.

Men have unjustified prejudices about using some animals for food. Rabbits are eaten as chicken by people who profess they cannot eat rabbit. Muskrat is reported to be splendid food, but the carcasses are rarely eaten. Some people think that the flesh from red cattle is superior.

It is fun to map the world on the basis of the foods men get from domestic animals. In some parts, the milk must be soured before it is accepted. In some, the milk commonly used comes from cattle; elsewhere from goats, sheep, mares, yaks, camels, llamas and so on, and from each of these kinds of milk, cheeses of different properties

are produced. Fermented milks, such as have been used for generations in Russia, Turkey, Rumania and the Balkans, in recent years have been found to have therapeutic properties not formerly recognized. Such inventions as the Babcock tester, which makes it possible to learn whether a cow is earning her feed, and to set certain standards of quality for milk sold in the open market, have gone a long way in teaching us how to produce almost any kind of animal food product efficiently even though we may not know how to market it fairly.

Some Unusual Uses of Domestic Mammals

A friend of the writer is busily engaged trying to raise fifteen pounds of cockroaches on diets that have or lack certain vitamins. When he has a sufficient supply he will feed these to rats to determine whether the diets of the cockroaches may affect the development and health of the rats that eat them. This may sound a bit strange but most of the important progress made in dietetics and disease in recent years has been based on experiments with animals other than man himself.

We have found that in many respects monkeys, rabbits, dogs, guinea pigs and rats behave as do men. Some object to the use of these animals in the solutions of men's problems. Greater still is the number of people whose lives have been saved from the plague, smallpox, rabies, pellagra, tularemia, diabetes and other diseases because of experimental work with these animals. There is every reason to believe that, given freedom from the economic drain of war, we may, in the relatively near future, be able to understand better how to control such scourges as spinal meningitis, rheumatic fever and even the common cold, which so seriously interferes with the enjoyment of our lives to the utmost. To the dumb animals who have helped us in understanding ourselves we owe a debt of gratitude.

Less spectacular are many of the commonplace uses made of various parts of domestic animals killed primarily for food. We do not eat the bones, the entrails, the blood, or many other parts of animals, but we use them in other ways. A string quartet appeals to our esthetic sense. Its music is produced by drawing some hairs over the stretched entrails of domestic animals. We look at a great dirigible, yet may not realize that it is essentially great bags of animal tissue surrounding some gas that is lighter than air.

A piece of cheese flipped at a workman during the noon hour missed its mark but landed in a vat in which materials were being mixed to (Continued on page 572)

COMMON NAME SCIENTIFIC NAME	PERCHERON HORSE *Equus caballus*	BURRO OR DONKEY *Equus asinus*	MULE *Equus asinus x E. caballus*	CAMEL *Camelus dromedarius*
DESCRIPTION	Reaches a maximum of 17 hands or 68 inches high at withers. Short-legged, compact forms are popular. Feet, large and not long-haired. Chest, deep and broad. Back, short. Loins, smooth and well-muscled. Color, may be gray, chestnut, roan or brown, but black and gray are most popular.	Varies in height from 30 inches to that of a good-sized horse. Ears, long. Tail, sparsely haired. Eyes, deep-set. Body, generally not so heavily- or smoothly-muscled as that of a horse. Mane, wiry, uneven, coarse. Legs, medium in length. Feet, smaller. White to black, commonly with white nose, belly and flanks.	A draft mule weighs about 1200 pounds; is about 16 hands (16 x 4 or 64 inches) high at withers; farm mule, 1100 pounds, 15½ hands; mining mule, 600 to 1300 pounds, 12 to 16 hands. Mules retain the long ears, small feet, sparse tail and bray of the jackass father, but those like mother are most valuable.	Arabian camel, with one hump; Bactrian, with 2 humps on back. The former, a little the larger, is 6 to 7 feet tall at shoulder. Long neck and legs. Feet, two-toed, soles being undivided and the hoofs on the upper surface. Hair, soft and unevenly placed, longest on head, neck, shoulders, hump and thighs.
RELATIONSHIP AND DISTRIBUTION	Family Equidae of the Ungulata. This breed developed in the Perche district of France and was associated with the fortunes of the Crusaders. Became popular in America during Civil War times. Domestic horses developed from wild horse of Asia, a descendant of the *Eohippus,* which was about the size of a collie dog.	Family Equidae of the Ungulata. The jacks of France are probably the largest; those of western India and Ceylon, the smallest. Asses are found wild in Africa and Asia. Various breeds were brought to America with the Spanish explorers. Important breeds: Andalusian, medium-sized; Maltese, small; Majorca, large; Poitou, very large.	Hybrid of certain Equidae in the Ungulata. The animals are used the world over for a variety of tasks. In the United States about 90 percent of the mules are in the South on farms, and they are, in general, more common in the warmer parts of the earth. Probably have been produced ever since horses and asses were domesticated.	Family Camelidae of Ungulata. Arabian camel used in both Africa and Asia, and Bactrian camel used in China, Mongolia and eastern and central Asia generally. Arabian camel introduced rather unsatisfactorily in southern Europe, southwestern United States and in Australia. The Bactrian not so widely used.
LIFE HISTORY	A mature, male *stallion* mates with a mature, female *mare.* In 11 to 12 months one or two *foals* are born. These, when weaned, become *weanlings.* A male, castrated when young, is a *gelding;* one castrated when mature is a *stag.* A *filly* is a young female; a *colt,* a young male. A young Percheron may weigh as much as one ton when 2 or 3 years old.	The male is known as a *jack;* the female, as a *jennet.* Some are known as donkeys. The American Breeders Association of Jacks and Jennets was organized in 1908 and has done much to improve our animals, which, in this country, are used almost solely in the production of mules. For this purpose, large animals are generally to be desired.	A *mule* is the result of mating of a male ass and a female horse. A cross between a female ass and a stallion, or male horse, is a *hinny.* Hinnies are supposed to lack some of the good qualities of a mule, but this prejudice may not be justified. They are born about a year after the parents mate. Reports of female mules bearing young are not well supported, and with some it would be impossible.	A single calf is born at a time; is suckled at least 12 months by the mother. During first year, young may be carried in nets during forced marches: Young do not reach maturity until at least five years old. They will be commercially valuable until 25 years old and may live until 40 years old. Milk is thick, rich and considered by some superior to cow's milk. Breeds every 2 years.
FOOD AND OTHER HABITS	Patient, powerful, kindly animals with good memories. Young horses should grow steadily during first two years. Oats popular as grain food because hull lends bulk and prevents gorging. Timothy hay generally better than legume hay. After working, horses should be given a small drink; then, when rested, should be watered again and then fed.	The animals have food habits similar to those discussed under "mule". They are more patient and hardy than horses or mules, travel slowly but cautiously and safely over difficult territory, and are able to get subsistence from fields that would not support most other draft animals.	Mules' food is much the same as that of horses. They are not inclined to eat much when heated or tired, but must have ample food to consume during periods of rest. Probably mules were brought to America as early as the Sixteenth Century by Spaniards. They are almost always patient, hardy, capable animals, lacking nervous qualities of their mothers but possessing their strength.	Food is vegetation, either herbs or woody plants. Some green, succulent material necessary for continued health. Can store water in stomach, but in hot weather must renew supply at end of three days. Reserve food stored as flesh on hump, this area becoming thinner as animals are starved. Camels are stupid, occasionally vicious, but generally obedient to will of man.
USE TO MAN	Horses in United States dropped from 16,000,000 in 1925, to 12,000,000 in 1935, to 11,000,000 in 1938. Of draft horses Percherons outnumber any other breed 7 to 1. They are quick and powerful, popular as war horses, in agriculture and for short-haul work. Other breeds are useful in other situations, from racing to doing tricks. Some used for producing serums against disease.	The burro used in southwestern United States, Mexico and elsewhere may be no larger than a Shetland pony but can carry a load of 250 pounds over rough trails. Domestic asses were developed from African wild ass. In Arabia, the flesh of wild asses is eaten regularly. The domestic animals are frequently used as pets.	Mules make ideal army draft animals. In war times may sell for $500. Before Italy's conquest of Ethiopia American mules were bought so freely that our supply was very low. Since a mule cannot be put at hard labor under 5 years from time the parents mate, and many until 8 years, their production preceding times of war may be highly profitable. 4,477,000 U. S. mules in 1938.	May carry load of 400 to 600 pounds three miles an hour up to 10 hours a day; faster animals may carry light loads nearly 100 miles in 10 hours. Milk is used as food; curdles when put into tea or coffee. Flesh resembles beef when boiled or roasted. Hide makes excellent leather. Hair is made into cloth, although "camel's hair" is commonly goat hair. The dung is useful as fuel in deserts.

ELEPHANT *Elephas indicus*	WATER BUFFALO *Bos bubalus*	HOLSTEIN FRIESIAN CATTLE *Bos taurus*	GOAT *Capra hircus* and *C. angorensis*	LLAMA *Lama peruana*
Indian elephant is smaller, has smaller ears and is more easily tamed than the African elephant. Males larger than females, weighing up to five tons. Skin is tough and may be an inch thick, is almost hairless except near tip of tail and is generally well wrinkled.	Height at shoulder, 5 to 5½ feet; horns, 8 to 12 feet from tip to tip along the curve and backward-pointing as contrasting with the forward-pointing horns of *Cape buffalo.* Length, 9 to 10 feet from nose to tip of 2-foot tail. Color, gray to black with the legs distinctly lighter. Horns of cows slenderer than bulls'.	Bulls weigh one ton or more, with heavy-framed, lean bodies. Necks, muscular. Horns, incurving. Cows, smaller, with more slender necks, large bodies and large udders; mild; weight, average 1,200 pounds. Color, black and white, blotched, although there may be red animals. Largest dairy cattle.	Hollow-horned animals. Angoras weigh 60 to 100 pounds. Males, with 18- to 20-inch horns, and does, 8- to 10-inch horns. Milch goats smaller and often hornless, with bodies proportionately longer and hind parts larger. Angoras, long-haired; milch, short-haired. Bucks larger than does.	Length, 4 feet. Tail, ½ foot. Height, 3 feet. Neck, nearly 2 feet. Body, broad. Legs, thin. Toenails, sharp talons. Hair, thick, soft and shorter on head and ears. Color, commonly white or brown. The alpaca is larger but slighter, longer-haired and with a smaller head.
Family Elephantidae of Proboscidia of the Ungulata. Forefoot of African, usually 4-toed; hind, 3-toed; of Indian, 5 and 4. Indian or Asian elephant is found through southern Asia, the Malay Peninsula, Ceylon and Sumatra. The African ranges south of the Sahara through the wilder parts of central Africa.	Family Bovidae of the Ungulata. The domesticated water buffalo is an Indian buffalo native of India, Ceylon, the Philippines and the Malay Peninsula. The Cape buffalo ranges in eastern Africa. Both are water lovers, spending much time nearly submerged in it, particularly in grassy swamps near the sea.	Ungulates of Family Bovidae. Holsteins developed in Holland and Friesland and generally used over prosperous lowlands of Europe. Introduced into America about 1795, and, through unwise crossing, depreciated. Later importations brought quality up, and now high grade herds are common in most dairy country.	Ungulates of the Family Bovidae. The domestic goat is probably derived from the Persian wild goat of the mountains of Asia Minor. Other kinds include the long-haired Angora; the Cashmere goat of Tibet (2 feet high); the long-eared, black-haired Syrian goat of Europe; the small Sudan goat; and the Egyptian goat.	Family Camelidae of the Ungulata. The llama and alpaca are derived from the wild *guanaco.* The llama is found in Peru, Bolivia and west coast of South America. In temperate climates like cooler Patagonia they come down to the sea, but in equatorial regions are found in Andes from 12,000 to 16,000 feet elevation.
One young born some 21 months after the mating. Baby weighs about 200 pounds and stands about 3 feet high when born. Jumbo, at 26 years of age stood 11 feet 2 inches at shoulder, weighed 6½ tons and probably had not completed his growth. In the wild, elephants live together in herds of up to 50 or more, with one or more old males providing a degree of protection. May possibly live to 150 years of age.	Generally two young are born to the water buffalo and the normal life is about 10 years, although under suitable conditions it may live an active life longer. The related Cape buffalo breeds in summer and the cow leaves the herd for some days or weeks when her young are born. Water buffaloes will not cross with domestic cattle.	Nine months after cows and bulls mate *calves* are born. Second year, these are *yearlings.* Immature females are *heifers;* immature males, *yearling bulls. Steers,* castrated, immature males; *oxen,* castrated, mature males. At 18 months, first pair of permanent incisors appear; second pair, at 27 months; third pair, at 36 months and fourth pair, at forty-five months. Cow may breed when from 1½ to 12 years of age.	Young *kids* are born from 147 to 155 days after the male, or *buck,* mates with the *doe,* or nannygoat. The two to four young are well developed at birth, can follow mothers in 4 to 5 days, mature in one year, are old at six years, but may live to 15 years of age. Kids not reared are slaughtered and sold as venison. Does may give milk for six months.	Llamas breed every two years. Young males are driven from herd by females, while older males fight each other for leadership. Mate in November and young (one) are born in May or June with conspicuously thin necks, bodies and legs. Llamas mate with alpacas but offspring are sterile. In captivity, llamas may live 12 to 14 years.
Food is vegetation, a herd of 100 animals requiring about 40 tons of fodder in a day. They also require much water and enjoy bathing, although the African elephants enjoy the hot sun. They may sleep either standing or lying down, and when travelling may make about 15 miles an hour by a sure-footed, rolling gait. They never canter, trot or gallop. They have many insect and parasitic enemies.	Food is mainly the grasses, such as hay or grain. The animals in wild or domestic state may be dangerous, although a trained animal may be handled safely by a familiar child. Stories of their courage, cunning, vengeance and strength are generally well supported by the facts. Apparently well domesticated animals may go wild on occasion and revert to a docile state just as quickly. Must have water.	Cattle were domesticated from wild cattle, which, until the Fifteenth Century, roamed the forests of Europe; when they were domesticated is lost in history. Common American breeds of cattle include, of the dairy type, the Jerseys, Guernseys, Ayrshires and Holsteins; of the beef types, the Aberdeen Angus, and Hereford; and of the dual purpose type, the Shorthorn and Swiss.	Food is almost any vegetation. Animals destructive to forests, have keen senses of sight and smell, are wary, restless, and delight in climbing to highest available elevation. Are exceptionally sure-footed. Make good pets, but the bucks in particular produce an unpleasant odor. One-year goat, 2 broad, front teeth, lower jaw; 2-year, 4; 3-year, 6.	Food is coarse vegetation including shrubs, lichens, mosses and grasses. If food is succulent, they do not drink. They live in large herds; are more intelligent than camels. Expel stomach contents in face of offender. Most of them are gentle and may be ridden or driven by children. Must have cool or cold climate to thrive at all well.
Indian elephant, possibly most intelligent of domestic mammals, capable of being trained to do intricate tasks. "Rogues" may do great damage to crops; may even kill men. Natives relish the flesh, the trunk and foot being preferred. The hide makes good leather. The animals formerly were all-important in war in certain areas. Tusks, most valuable source of ivory.	Probably the most useful draft animals where rice is raised and therefore common in southern Asia and in Oriental countries. In some regions, the chief source of milk and butter as well. The flesh is stronger, tougher and muskier than that of cattle; the calf flesh is much like pork. The hide makes a superior quality of leather and the horns are useful.	In 1938 there were in America about 25,000,000 milk cows, worth $1,355,926,000; about 41,000,000 other cattle, valued at about $1,100,000,000, or roughly about one-eleventh of the cattle population of the world. Some 80 Holstein cows have records of more than 1000 pounds of milk fat a year. One cow one year produced an average of more than 90 pounds of milk a day.	Milch goats must be milked thrice daily giving 2 to 8 quarts of rather strong but nutritious milk; kept by 75 percent of German families. Hides produce morocco leather or parchment. Angora goats produce fleeces weighing 3 to 5 pounds of 8-inch hair which is made into mohair cloth. Animals are sheared twice a year in the South and once in the North.	Valuable for fleece, although males have been used as beasts of burden, each carrying about 100 pounds. The alpaca has the superior fleece, producing 11 to 15 pounds when sheared every other year. Flesh of young llamas is tender, but that of older animals is too tough except for drying. Efforts to establish them in Australia and Europe have failed.

COMMON NAME SCIENTIFIC NAME	BERKSHIRE SWINE *Sus scrofa*	SHEEP *Ovis aries*	DOMESTIC RABBIT *Lepus cuniculus*	GUINEA PIG *Cavia cobaya*
DESCRIPTION	Medium-sized, rarely more than 900 pounds in weight. Body, long with good depth and medium width. Snout, short and upturned. Ears, erect. Color, black with white markings, with 6 white marks becoming fixed as standard of perfection. Berkshires, black and white; Yorkshires, white; Duroc-Jerseys, red.	Southdown breed (mutton), weigh up to 190 pounds; Merino (fine wool), up to 140 pounds, and Shropshire (general purpose), to 250 pounds. In all cases, the ewes are about ⅓ less in weight, are less aggressive but both produce commercial wool proportional to weight.	Wild European rabbit from which domestic rabbit is derived may weigh from 7 to 12 pounds, although domesticated Dutch rabbits may be as small as 1¼ pounds. While wild rabbit has erect ears, domesticated forms with 23-inch lop ears are bred. Fore feet, 5-toed; hind feet, 4-toed. Upper incisors, 4.	About 10 inches long. Weight, about one pound with stout, heavy bodies. Legs and tail, short. Front feet, 4-toed. Hind feet, 3-toed to 5-toed with large, angular nails. Fur of wild animals, coarse, rather long, and usually grayish brown. When hungry, gives grunting sounds like pig.
RELATIONSHIP AND DISTRIBUTION	Ungulates of Family Suidae. Hogs have probably been domesticated some 4000 years, and they have existed on the earth possibly 6 million years. Berkshires were developed in England by crossing English with Chinese and Siamese hogs. Introduced into America about 1823. Generally popular, particularly in Canada.	Ungulates of the Family Bovidae. The Southdown originated some 200 years ago in eastern England; the Merino, in Spain some 2000 years ago; and the Shropshire, in western England about 1850. Merino is probably the commonest sheep in America and is most popular in the West.	Rodents (Lagomorphs, recent authors). The Belgian "hare" is a true rabbit while the cottontail rabbit is a true hare, the former commonly burrowing while the latter does not. Except for dog, no other mammal has probably developed more variations under domestication than the rabbit. Found domesticated in most parts of the world.	Rodents, classified between the mice and rabbits with some 20 wild species and many more domesticated varieties. Although there are varieties, named English, Peruvian, Angora, Abyssinian, and others, the animals undoubtedly originated in South America, "Guinea" being a corrupted Guiana.
LIFE HISTORY	Newly-born swine are *pigs*. When weaned, they are *shoats*. Young female, a *gilt;* mature female, a *sow*. Mature males, *boars;* castrated males, *barrows*. Sows a year old may be bred and 112 days after mating young are born. Older sows may produce two litters a year. Mother may be separated from young in 10 to 12 weeks.	One active *ram* (male) not less than 1 year old is bred to from 35 to 50 *ewes* (females) not less than 1½ years old, and in 146 days young (lambs), often twins, are dropped. Ewe needs 16 square feet of floor space to care for young which nurse in 2 hours. Lambs at 2 weeks begin to nibble hay; marketable at 4 to 6 months. *Wethers* are castrated rams.	After mating of the female, or *doe,* and the male, or *buck,* the young are born in from 30 to 32 days in litters of 4 to 12 or more, the young remaining blind for a number of days, being cared for splendidly by mother. May have 6 to 8 litters a year. Families stay together, many families often living together in harmony.	While wild guinea pigs breed but twice a year, domesticated varieties may breed every two months after maturity and mature in three to five months after birth. Young born 61 to 63 days after the mating and at birth have open eyes, fully developed hair; may run about a few hours after birth. Litters of from 4 to 12 or more though wild animals average 1 to 2.
FOOD AND OTHER HABITS	Pigs are not naturally unclean but feed on roots and underground plant parts naturally. Also eat insects and small animals on occasion. Swine have a good sense of hearing and of sight if properly cared for. These senses may be poorly developed if food is improper. Legume hay is highly recommended, particularly in winter. Since stomachs hold about 8 quarts, hogs must eat frequently.	Food is vegetation cropped close to the ground. Best if contains clover. Sheltered sheep are fed legume hay and grain mixture of corn, 4 parts; oats, 4 parts; linseed or cottonseed cake, 2 parts by weight. Salt should always be available. Pregnant ewes require about 1 to 2 pounds of silage, ½ to 1 pound of straw and 3 pounds of corn stover.	Easily cared for if given dry quarters with water available, a place to burrow and an abundance of food. Food, mostly vegetation, but may eat flesh in captivity. Generally feed at night, or when light is not strong. Individuals may warn others of danger by thumping ground with hind feet. Hares do not normally care for young so well as do the rabbits.	Live on vegetation only in wild, feeding usually when sunlight is dull. Never bite. Have an unpleasant odor but make gentle and popular pets. Cannot stand low temperatures. Young, independent of mother after about three weeks. Wild animals burrow in sand or prefer living in vegetation-covered marshy areas.
USE TO MAN	In 1938, there were 44,418,000 hogs in the United States worth nearly half a billion dollars. Berkshire hogs rank fifth in popularity in the United States and second in Canada, but for bacon, hams and shoulders they lead. Duroc-Jersey and Chester White are important lard producers and Yorkshire is a superior bacon type.	1938 U.S. population, 53,000,000, worth about $324,000,000; number greater but value less than with hogs. Southdown ram's fleece may reach 10 to 12 pounds; Merino ram's, 30 pounds of finest quality; Shropshires average 10 pounds of good quality. Ewe's fleece weighs less. Milk used to make Roquefort cheese. Hides made into leather; flesh, mutton or lamb. Southdown lamb may weigh to 90 pounds in 3 to 4 months.	Bred for hair, flesh, genetic studies, medical experimentation, hides and pleasure. Angoras may have hair 7 inches long while silver-grays have short, thick, chinchilla-like fur. Cheaper fur coats—"lapins"—are rabbit; while they lack durability of many wild fur-bearers they serve well for their cost. Belgian hares are efficient flesh producers; probably greatest service is in medicine.	Were domesticated and raised for food by Incas of Peru before Europeans came. Now bred for studies in heredity and in medicine for the production of serums, for the isolation and production of disease-producing organisms and as pets. Their important contribution to modern society is unquestionably in connection with medical research. Popular with certain groups of fanciers.

RAT *Rattus norvegicus*	COLLIE DOG *Canis familiaris*	CAT *Felis domestica*	MONKEY	MAN *Homo sapiens*
Body length of year-old animal, about 9 inches; weight, about ⅓ pound. Norway rat, brown. Black rat, smaller and darker. Albino or white rats are almost entirely white forms of the Norway rat, although albino black rats are known. The white rat of the laboratory is a relatively harmless animal.	Collies stand about 20 to 24 inches high; weigh 40 to 60 pounds. Hair, long and fine. Nose, long and slender. Ears, droop or are erect. Color, black and tan, or rich brown, or white with bluish-gray cast. Graceful, dainty and highly intelligent. Pupils of eyes, round.	Length, normally about 2½ feet, of which about ⅓ is tail. Sharp, curved retractile claws. Foot-prints almost round and showing hind foot superimposed on track of front foot alternating and up to 9 inches apart. Fur, varying greatly.	South American (Cebidae), small, thumb and big toe opposable; nostrils, widely separated; toes and fingers, nailed; tail, prehensile. Old World (Cercopithecidae) usually all limbs about equal length; tail, usually long, never prehensile. Thick patches on seat. Nostrils, close together.	Average weight, between 100 and 200 pounds. Usual height, up to 6 feet. Walks erect on hind legs. Has mentality greater than other animals. Important races, the white or Caucasian, the black or Ethiopian; the brown, or Malay; the red, or Indian, and the yellow, or Oriental.
Rodents. Established in China, Japan, India, western Europe, North America and elsewhere. Came into Europe in Eighteenth Century, to England about 1729; Prussia, 1750; Paris, 1792; United States, about 1775, following house rat into Europe by about 600 years. Did not originate in Norway.	Order Carnivora. Family Canidae. Collies were developed primarily as sheep dogs until recently when they have been used more as companions. In sheep raising in England, Scotland and Wales, the animals are indispensable. Collies vary greatly in different parts of the world.	Carnivora. Family Felidae. European, tabbies or tortoise-shell; latter, usually female. Manx, long hind quarters, little or no tail. Asian, Persian or Angora, long silky fur. Siamese, fawn color, black head and legs, blue eyes. Chinese, long silky ears. African, stiff, wiry hair. Paraguay, short, close, scanty hair.	Order Primates which also includes the Hominidae (men) and the Simiidae (apes). The Cebidae are arboreal. The Cercopithecidae include the rhesus and other Indian monkeys, the tailless Barbary ape, which is found on the Rock of Gibraltar, and the African monkeys. In the apes, the forelegs are longer than the hind, and tail is absent.	Family Hominidae of the Primates. Probably developed in the Eastern Hemisphere and spread from there to all parts of the earth that was capable of being modified to provide the necessities of life for the species. Probably appeared in Pleistocene times as Java ape man about 950,000 B. C.
Mate any time of year, and 22 days later about 6 blind, naked, helpless young are born. Ears open in 3 days, eyes, 14-17; sexually mature in 2 months; double weight six days after birth; cease reproducing at 18 months; may live to old age of 3 years. In wild state, may produce 6 or more litters annually. Live about 30 times as fast as man.	Since wolves, jackals, coyotes and dingos mate freely with dogs they are obviously closely related. After the male *dog* mates with the female, or *bitch,* the puppies are born in from 59 to 63 days. The *pups* are blind until from 10 to 12 days and are more or less helpless. The life of a dog is from 10 to 15, or occasionally 20 years. Normally, senses of hearing and smell are acute.	*Kittens* are blind and relatively helpless at birth and are born about 63 days after the mother is mated. They are cared for and defended by the mother. Iris of eyes of adults usually yellow; of kittens, often blue or green. Males commonly larger than the females.	In monkeys, the period from generation to generation is never less than 3 years and in apes probably never less than 12 years. Apes approximate development of man through infancy, adolescence, maturity and old age but in all of these monkeys follow a shorter cycle as illustrated by the maturity ages of 3 years in the more precocious monkeys to 12 years in apes.	Young, born nine months after mating of parents, more or less helpless at first and through period of infancy of one year. Childhood and adolescence follow, when greatest growth takes place. Girls mature earlier than boys throughout most of life but may live as long. Physical decline may not begin until after 70. Senility may be delayed until end.
Food, almost any organic substance. Will attack humans and have killed pigs and calves. Respond to diets much as do men and will work in unison to get food. Subject to many of diseases of man and a carrier of bubonic and pneumonic plagues, trichinosis in swine and tuberculosis in poultry. Black rat survives cooler climate than the Norway rat and is less aggressive.	Food, normally animal matter. This they catch by pursuit and kill by biting. Uneaten surpluses are hidden for use later. Dogs are not so careful about what they eat or drink as are cats or horses. Graceful, intelligent animals, although prize-winning show dogs are not always the most brilliant mentally. In Bible times, the dog was looked upon as unclean, but some ate them.	Food, principally animals caught by surprise and a sudden dash; killed by piercing with long slender teeth while being held by fore-feet. Cats can see with little light. Eyes reflect lights. In strong lights eyes show slender vertical slit. Cats are independent, living essentially selfish lives. Little sense of smell compared with dogs, but excellent sight and hearing.	Food, essentially plant materials but this varies. While gibbons have but single mates, the rhesus or sacred monkeys mate promiscuously. The rhesus monkeys are particularly susceptible to many diseases of man, behaving as does man when having infantile paralysis, for example. Because of this they are valuable experimental animals. In the native India, these are considered sacred.	Food, a variety of organic materials with some mineral substances, most of which may be stored and modified by man to suit his convenience. Intelligence in controlling the causes of his own diseases is possibly most remarkable character as well as his ability to create new materials through use of natural forces. These abilities possible only because of superior reasoning power.
Wild Norway rats destroy about $200,000,000 worth of agricultural products in United States and $20,000,000 in Canada annually. Probably our worst pests. Barium carbonate, 1 part to 4, with a soft food is an effective but dangerous poison control. Albino laboratory rat, one of most useful animals in studying disease, ranking well with guinea pigs and monkeys; make superior diet demonstrations.	Collies have been known to herd 3000 sheep, driving rams into one corral, the ewes into a second, and lambs into a third, in spite of habit of sheep to stampede after any leader. Collies have surprising memories. Some develop criminal instincts. Dogs are important messengers and beasts of burden in Arctic regions and under particular circumstances; valuable in medicine as experimental animals.	Long domesticated. In Egypt were considered sacred and at death were embalmed. Are probably loved or hated or merely tolerated by most people, but economically are carriers of hydrophobia and other diseases, and are birds' worst enemies. Destruction of mice probably not commensurate with bird destruction. Should be confined, particularly in nesting season. New York has law designed to curb cats.	Rhesus monkey, worth from 8 to 25 dollars as experimental animal in studying disease. Colony of 500 animals established on a 36-acre island off Puerto Rico. At Orange Park, Florida, Yale and the Rockefeller Foundation maintain an Anthropoid Station for studying primate biology. A fund of $189,000 has been set aside to maintain this station from 1939 to 1944.	Uninformed man, a dangerous agent of destruction, as shown by slavery, war, and misuse of natural resources, and even some inventions. Informed and cooperative man has produced great works of art, religion, philosophy, poetry, music, literature, engineering, education and sociology; of these some are made by other species but nothing comparable to that of man. Often a slave to ridiculous prejudices, superstitions and mass judgment.

(Continued from page 567) make phonograph records. The resulting records were superior to those made without the casein the cheese supplied.

Should we attempt to go into the unique uses of animal products we should have to recognize that they supply us with certain kinds of sandpaper. They help harden steel and concrete. They give us gold beater's skins with which we can beat out thin sheets of gold. They provide us with substances with which we can sew wounds together; with dice with which some people lose fortunes. They enter into the making of moving picture films with which fortunes are made. The intestines of lambs are used to string tennis rackets. Properly processed, animal products may make anything from a baby's rattle and a pipe bowl to bindings for books and waterproofing for leathers and fabrics.

Can you recognize the parts of animals used in making orchestral instruments; in making glue used in furniture and in books; in making buttons, shoes, and the host of plastic trinkets that have animal products in them? If not, inquiries in these directions may prove to be exceptionally illuminating.

Domestic Mammals Through the Ages

Mary and her little lamb; the cow that jumped over the moon; the cow with the crumpled horn that tossed the dog that worried the cat; Puss-in-boots; Baby Bunting's rabbit skin; and the pig that was stolen by Tom, the piper's son, are domestic mammal characters known to every child. The GOP elephant, the Democratic donkey and the Prohibition party's camel are well-known symbols to most adults. But how many people know the extent to which many domestic animals are worshipped, even today?

When a person died in ancient Rome, hogs were sacrificed to clear the house of the pollution of the dead body. They were also sacrificed at the conclusion of treaties or agreements, the contracting parties dipping their hands in the blood and then shaking hands. It is possible that contracts so sealed were more fairly adhered to than are some modern contracts negotiated—say those of the Rome-Berlin axis. The idea of sacrificing the hog in ancient Rome was that should the contract be broken the one breaking it would be liable to the same fate as the hog.

In India hogs were sacrificed in the belief that this would provide protection from cholera. Possibly the fact that eating fat meat in warm countries does not produce pleasing results may have justified prejudices against hogs. Plutarch claimed that hogs were disliked by the sun and the moon and that they were responsible for the moon becoming dark at intervals. So resentful have some races of humans been to hogs that persons wearing shoes made of hog skin were not permitted to enter temples. Those who tended hogs were not permitted to marry except with those similarly engaged.

Sheep have had their place in influencing human customs. They were long used as sacrificial animals in spite of the fact that the leader of the Christian religion is often spoken of as the Good Shepherd and is pictured holding a lamb. In Czechoslovakia, Hungary and other countries it has long been the cruel and certainly senseless custom to throw a ram from the church tower in the autumn to assure a good crop next year. Similar long-distance weather planning provided good weather in the spring in Finland if the gods were satisfied by the killing of a lamb the preceding fall. When one reads of this type of behavior by the human species he must realize that human behavior is not always any more intelligent than that one expects of dumb animals. It is not surprising under these circumstances to find that in Madagascar sheep are treated kindly because they are believed to constitute the residence of one's ancestors and for this reason sheep flesh is not eaten by some people for fear that an ancestor might be served up with the rest of the meal.

The American Indians, often designated as savages by the more enlightened Europeans, often recognized dumb animals as their brothers. They frequently apologized to them for taking their lives and killed only when the animals were needed for food or clothing. When the continent became overrun with a race that considered itself wiser the supply of these useful wild animals waned.

Horses have ranked high in value at most times though possibly none went higher than did Pegasus the flying horse. Shakespeare has King Richard III offering a kingdom for a horse. But man's interest in or curiosity about horses probably reached an all-time high when the people of Troy came out to look over the wooden horse that had been drawn up in front of their gates and thereby lost their city. Since that time horses have made and broken men and nations.

Acknowledgments

This article is based on a similar one by the author published as a number of the Cornell Rural School Leaflet by the New York State College of Agriculture at Cornell University. Modifications felt to be improvements have been made to that leaflet, in response to reactions received. Appreciation is expressed to the College for permission to revise the material, and to the books that were used to supplement the author's personal experiences. Suggestions for school room activities appear on the School Page. The illustrations are by Hope Sawyer and are copyrighted. The books most commonly used are as follows:

Livestock in Mythology and Religion. Monthly Letter to Animal Husbandmen, volume 9, number 1. Armour's Livestock Bureau, Chicago, Illinois. 1928.

Mankind's Best Friend—Companion of His Solitude, Advance Guard in the Hunt, and Ally of the Trenches. Ernest Harold Baynes. The National Geographic Magazine, volume 35, number 3. Washington, D. C. 1919.

The Story of the Horse. William Harding Carter. The National Geographic Magazine, volume 44, number 5, Washington, D. C. 1923.

By-Products in the Packing Industry. Rudolf A. Clemen. The University of Chicago Press, Chicago, Illinois. 1927.

The Pet Book. Anna Botsford Comstock. The Comstock Publishing Company, Ithaca, New York. 1914.

The Taurine World. Cattle and Their Place in the Human Scheme—Wild Types and Modern Breeds in Many Lands. Alvin Howard Sanders. The National Geographic Magazine, volume 48, number 6. Washington, D. C. 1925.

The Book of Rural Life. Edward Mowbray Tuttle. Bellows-Durham Company, Chicago, Illinois. 1925.

green grapes instead of purple; white raisins; bits of sponge or angel cake. He has a fondness for ice cream.

When offered something that does not please him, he knocks it from my finger with his beak, or politely accepts it, to be dropped immediately. He occupies commodious quarters—a huge parrot cage with a rod leading from the open door to his tree on a standard beside the plant stand.

There he spends days watching birds on a tray outside. This arrangement was designed to give him exercise and free access to food and water kept inside the cage, and it has promoted activity and confidence far beyond our expectations.

Nature is such a wonderful healer, and takes care of her own so perfectly, that we did not undertake treatment for the broken wing. Unfortuately, however, it healed in a drooping position that has permanently disabled him. He now goes from room to room, but flight is difficult, more or less spiral and unguided, although he often makes a safe landing on the back of a davenport or chair. Unable to rise from the floor, Buddy will come running toward me, wings extended like a miniature airplane about to take off, and hop on my hand to be lifted.

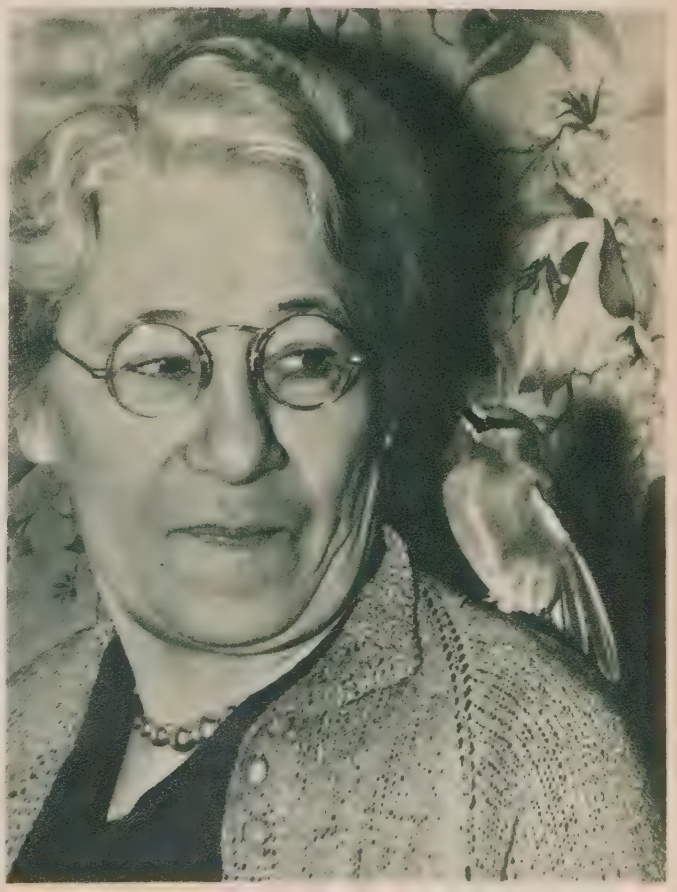
For diversion, he is carried upstairs every morning, where he sits on the back of a chair while the work is being attended to, then is brought back to his perch on the plant stand. When we settle down for the evening, he begins his little teasing note and if not escorted to where we are, comes under his own power and is much disturbed and unhappy if not allowed to sit upon our shoulders for the entire evening.

As friendly as he is, he resents being enclosed in my hand and gives a pathetic little note as if hurt. He is forcibly held long enough to give him an airing at the open door each day, and he invariably shakes himself with relief when it is over.

Waxwings are not credited with musical ability, but this bird has a definite idea of singing. He sits in the sun for twenty or thirty minutes and continuously murmurs soft lisping notes interspersed with throaty trills and variations, a performance that could not possibly be interpreted otherwise than a real song.

Buddy came to us in immature plumage so we were unable to determine whether he was really he until the March moulting, when all the characteristics of a male bird developed. It was especially interesting to watch the progress of new tail feathers. First there were tiny crescents of yellow close to the body. These came in opposite pairs, and, when one set was well advanced, another appeared, until the tail was complete—the yellow tips a broad band.

These little creatures develop real personalities, and by constant and careful observation one learns many secret "ways of the wild". Their sudden emotions, their moods and tones, express a language that is comprehensible to the human mind. Buddy broadcasts his intentions and desires to a remarkable degree. A certain loud call means food, for he prefers to be fed, but if ignored, he goes to the cage and helps himself. A scream tells us he is about to take a flight. A sharp "chip" announces a bath, and a throaty buzz means, "No, thank you". He expresses great delight when we come down in the morning, and simply sulks when shut in his cage for us to go out. He quickly recovers, however, upon our return.



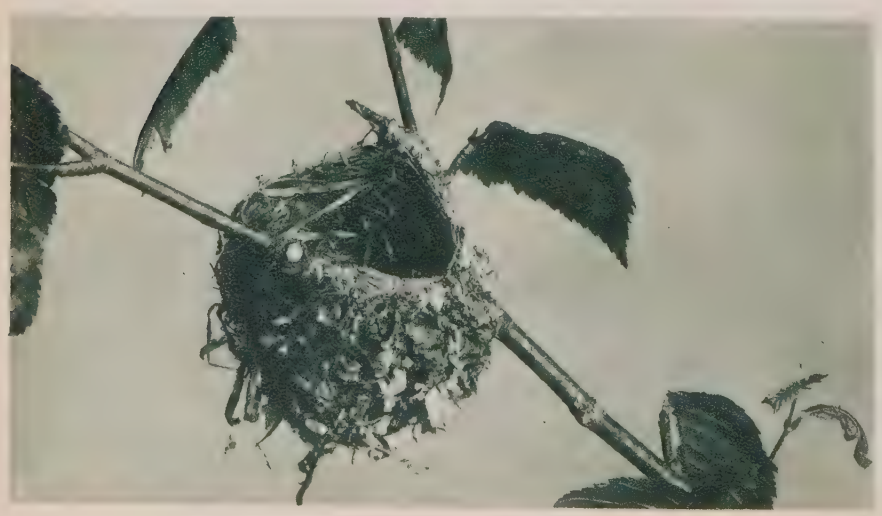
Interesting contrast in the nests of the black-throated blue warbler (left) and of the black-throated green warbler. The former selects the lowest twigs of spruce and fir seedlings in the open spaces in the woods, or on border woodlands, and likes to use coarser stuffs, such as wide strips of bark fibre and pieces of birch bark, binds it together with animal silk. Its green cousin prefers fine curls of birch bark; lines the nest with downy feathers and hair of squirrel or rabbit, and likes a location a bit higher than the black-throated blue.

WHAT OF THE NEST?

Photographs by Cordelia J. Stanwood

Although winter in the North begins its sway long after the summer bird visitors have winged away to gentler climate, the birds have left behind mementoes of their stay. These are their nests, now untenanted and, in some cases, weather-worn. These erstwhile nurseries still hold our interest. We marvel at the cleverness of birds in constructing their homes, and at their variety in form. And we may also learn certain things from a study of these nests. Birds, in a given habitat, are likely to choose the same general type of location and materials in the construction work. It is often possible, therefore, to name the builder with no evidence to help us save the position and architecture of its long-abandoned home.

Miss Cordelia Stanwood, of Ellsworth, Maine, has spent a lifetime in the study and photography of birds. She calls her home "Birdsacre", and it is there and nearby that she obtained the interesting comparative pictures of nests reproduced in these pages.



Animal silk, willow down, *Usnea* lichen, birch bark, wasp paper or bark fibre may go into the red-eyed vireo's nest. These are always finely shredded, and carefully felted together. This one is decorated with curls of white birch bark and snowy willow fluff.

The parula warbler, two of whose nests are shown above, chooses sites where there is a supply of *Usnea* lichen, from which she fashions her home. Sometimes the lichen quite conceals the nest, and, at other times, it is looped up over the branch. Then one finds a beautiful little basket. The lining of the nest is also of the lichen. Spider silk is often used to secure the sides of the nest, leaving an entrance at the back and front.

The golden-crowned kinglet seems to prefer the black spruce for its home-site. She fashions her nest from a fine, dark-green moss of the color as the foliage among which she builds. The nest is strengthened with slender spruce twigs and much animal silk. Miss Stanwood found one nest of this bird lined with the fluffy feathers of the ruffed grouse or "partridge." These were arranged vertically, the tips showing around the mouth of the nest, which was at the top. It appeared as though the tips of these feathers would curve inward and conceal the sitting bird.

The brown creeper, two nests of which are shown above, makes its home in old forests where there is more or less low land. The large firs in such an area may be winter-killed and the bark bursts and cleaves off in large flakes. Between the bark and the bole of the tree the creeper suspends her nest. This consists of small flakes of bark, weathered twigs, shredded bark fibre and animal silk. The nest is lined with shreds of cedar bark, or with miscellaneous matter such as fragments of yellow birch bark, lichen and dead wood. The lining is always soft and warm and the structure resembles a flattened pouch.

Where the tent caterpillar spreads its structures, the chestnut-sided warbler binds her dainty cradle to the stems of meadowsweet bushes. Sometimes the outside of the nest is shaped of coarse grasses and the lining made of soft, fine hay; at other times the entire structure is fashioned from caterpillar silk and fine hay. The nest of this warbler is usually carefully built.

★ Conservation ★

A part of Nature Magazine each month is devoted to the expression of practical opinions on the vital issues affecting our use and abuse of natural resources, including wildlife, and dedicated to the purpose of assisting Americans to play a militant part in the attainment of constructive conservation aims.

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FUR SUPPLY MENACED ★★

War conditions in Europe are considered by the United States Biological Survey to hold potential menace to the American supply of wild, fur-producing animals. It is pointed out that, in 1938, the United States imported furs to the value of $45,837,088. This is almost equal to the estimated domestic "take" during the same year. If, therefore, conditions abroad should materially reduce the supply available from extra-continental sources, our own fur-bearers will be drawn on to supply the deficiency. Thus some species would be threatened with dangerous depletion if not total extermination.

The regulation of the fur take in the wild is a matter largely under the jurisdiction of the states. The Federal Government has no authority over this activity beyond the control it may exercise over Federal lands on which wildlife management is practiced. The responsibility for the preservation of our supply of fur-bearing animals rests, therefore, with state game and conservation authorities. Most of the states keep no record of the take, and it is impossible to learn the actual conditions. The responsibility of the states has become a grave one.

"Not long after Columbus discovered America," says the Biological Survey, "the traffic in the continent's fur began. Since that time the fur resources of the country have been exploited with disastrous results. The persistence of any species in the presence of the almost overwhelming forces that tend toward its extermination is a striking natural phenomenon, and so far as the layman is concerned it completely conceals the decrease that is in reality taking place, creating the impression that there is no present or threatened danger of extreme shortage.

"It is difficult to conceive that in a civilized country so valuable a resource as fur animals has been so greatly neglected and wasted. We can't go on killing millions of fur animals forever without eventually coming face to face with their extermination. Surely a valuable resource that yields an annual income to trappers of $50,000,000 deserves much more attention than it is now receiving. A large majority of those who trap fur animals include farmers and their sons who depend upon this source of revenue to increase the farm income. The employment it furnishes and the income it supplies should be sufficient justification to arouse public sentiment for immediate action in order to save what is left of our fur resources."

The viewpoint here voiced presents only the commercial standpoint. It ignores our duty to maintain, to whatever degree our civilization permits, a reasonable population of all forms of wildlife, regardless of immediate commercial value, as component parts of an interrelated biota, and as sources of esthetic enjoyment. It ignores the fact that the wearing of furs is, after all, a luxury that may well be given up by a majority of people in the face of a world emergency. It ignores the cruelty that attends the taking of most fur animals.

As pointed out by the Survey, the situation is complicated by the fact that many of the states keep no record of the fur animals taken in any year. Thus it is impossible to learn the number harvested, and their money value, or to gain any clear idea of the breeding stock remaining. Every indication, however, points to a progressive decline in the number of our fur animals.

This, however, is a condition not peculiar to the United States. It is virtually universal. The feverish search for more valuable furs played an important part in the discovery of northern America, called for many generations the Fur Countries. Optimistically considered as inexhaustible, the fur resources of that great wilderness have been decimated by the rapacity of the fur trade. It is this shortage in North America that led to the upbuilding of an import trade valued at so many millions; these imports, of course, reduce the supply in foreign countries, even to the Tropics. Thus this drain on wildlife tends to become world-wide, instead of continental.

In times of world stress human beings everywhere must change their habits. Many industries suffer; some are even destroyed. The fur trade may well bear its part.

The Survey does well to point out the seeming indifference of the states as regards this important resource. By all means let each state take steps to learn the truth. A clear view of our actual resources in fur animals—and in game birds and mammals also—will open our eyes.

If fewer furs, including those now purely ornamental, were worn, the matter would right itself. Such action would be in line with intelligent practice in other fields, in game, forest and soil conservation, and result in a tremendous addition to the sum total of human happiness.

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Things to Think About

Beginning October first, thirty-five CCC camps were assigned to thirty-five national wildlife refuges through a program worked out by the Biological Survey and the Civilian Conservation Corps. The work of the enrollees will be directed toward water impoundment; gathering, storing and replanting aquatic and upland vegetation; constructing truck trails, roads and bridges; erecting fences and boundary markers; and assisting in the construction of patrol cabins and service buildings.

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Wisconsin hunters have been specially urged by Ralph C. Conway of the State Conservation Department's game division to observe the laws protecting beneficial hawks. He points out that identification on the wing is difficult and suggests that "if one will bear in mind the general rule that the hawk you can easily bring down with a shotgun, or even with a rifle, is not only perfectly harmless as far as game is concerned, but is actually very beneficial to the farmer, and is in almost every instance one of the protected species, the criticism of the Nature lover who resents any unnecessary slaughter can be easily avoided". In other words, leave any necessary hawk control to those who know what they are about.

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St. Andrews School for boys, situated near Middletown, Delaware, has established its grounds as a sanctuary "for animals, birds, plants and all wildlife", and invites visitors to come and enjoy them, and to help protect them. The grounds are so posted, and study of wildlife and conservation has become an important course in the school's curriculum. Several recent graduates have gone on to college to prepare for a life work in these fields.

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The Division of Grazing of the Department of the Interior has had its name changed to the Grazing Service. The change is made on the ground that the new name better indicates the broad conservation activities of the Service. These include scientific study of range vegetation, land classification, methods of preventing soil erosion, development of watering facilities, and other range improvement and protection work.

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Announcement of modest charges for admission to some National Parks and other areas under the administration of the National Park Service precipitated lively argument as to the propriety of such levies. A national study of the subject was made by James B. Williams and Ian Forbes, recreation planning consultants. This was done by the National Park Service at the request of the American Institute of Park Executives and with the advice of the National Recreation Association. The report, entitled *Fees and Charges for Public Recreation,* has been published and is available from the Superintendent of Documents, Washington, D. C., for forty cents in cash.

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Two important pieces of legislation of interest to conservationists have received consideration on the floor of Congress but failed to achieve enactment. These will be pending before the regular session opening in January. One bill is that providing for the establishment of Kings Canyon National Park in California. Reported from committee with provision reserving rights to irrigation and power developments within the area, these dangerous reservations were eliminated in the House of Representatives. The naming of the area after John Muir was also eliminated. However, the measure, as passed by the House and sent to the Senate, still does not provide for the inclusion of Tehipite Valley and the south fork of Kings Canyon within the designated park area. The American Nature Association has joined with the Izaak Walton League of America, the National Parks Association, the Wilderness Society and other groups in opposing the elimination of these two notably scenic areas that, logically, seem to belong in the park.

The second important measure, and one whose vital consequences no conservationist can ignore, is that relating to stream pollution. The Senate passed and sent to the House the so-called Barkley Bill, S.685, which postpones actual enforcement of pollution control for ten years. This measure would provide for investigation and voluntary cooperation in checking pollution. We hold that no further investigation is necessary. The facts of pollution and its lack of control are known. Voluntary cooperation has not been successful and holds no prospect of correcting a situation that now menaces the health of our people and the productivity of the water resources of this country. Led by the Izaak Walton League of America, conservationists who sincerely desire pollution control now urge the substitution of the Mundt Bill, H.R.6723, a real enforcement measure, for the innocuous Barkley Bill, which is actively supported by the lobbies of the polluting industries. This latter fact alone betrays its iniquity.

Remnants from the Pleistocene

Some facts about the antelope of the plains

By ALBERT C. ANTREI

Illustrated by the Author

THE white man says the antelope is gone from the plains. The red man puts their disappearance in a more poetical way. In these days, he says, there is no North Wind, no South Wind, no East Wind, or any West Wind. The wind on the plains today is a Crazy Wind, blowing frantically every which way in a dumb search for a blade of grass to bend; for something else to blow besides dust; for an antelope nose to bear a message.

Stories may come and stories may go, but wild animal stories will never grow old. None is perhaps more tragic —or more dramatic—than the story of *Antilocapra americana,* the pronghorn antelope.

The fact that the little prongbuck has never been romanticized in poem and prose to the extent of the bison did not save him from almost the same fate. Carload after carload of antelope carcasses once rolled into Denver from the surrounding plains.

The antelope could hardly be run down. Nature had equipped him with a quartet of lightning hoofs and accompanying sure-footedness that few, if any, horses could match. His natural curiosity was played upon, and curiosity did indeed kill the antelope. Hunters virtually lured him into the grave.

A million years or so ago, towards the close of the Geologic age known as the Pleistocene, the pronghorn antelope is said to have made its first appearance from doubtful and little-known ancestors. Whatever his ancestry, it is generally believed that the antelope has changed little since then, and that it appears today much as it did when in company with the last remnants of prehistoric bison, horses, camels, and others.

The Pleistocene was indeed a dynamic period. Four ice-sheets, accompanied by shaggy mammoths and huge musk-oxen, advanced and retreated across the brow of North America, in alternate attempts, as far south as Kentucky in the East, and Washington, generally, in the West.

Besides witnessing the rise of the pronghorn and the bison at this time, North America also lost some prominent plains citizens. Some four species of horses, about that time, melted mysteriously into the misty veils of extinction. Three Pleistocene camels are thought to have laid themselves to rest, never to rise again. Rumor has it that even a Nebraska giraffe sighed his weariness at the tribulations of this world—and became a fossil.

But, the prongbuck? Snorting and ejaculating his harsh "krah", he kicked up his heels at environmental changes, drifted one way or another with them, and rode the tide of mammalian dominance along with the bison.

When the Pleistocene had ended many of its characters departed to be lost in the darkness of prehistoric eras. Nature brushed aside the unfit, and left their bones imbedded in mud for scientists to puzzle about.

For a million years countless pronghorns galloped, unchanged and unmolested, over the plains and deserts of North America from Iowa to the Pacific Ocean; from Saskatchewan to the Mexican State of Durango. They enjoyed a million years of co-dominance of the habitable American plains and deserts. These were eras of freedom, centuries of super-abundance, followed overnight by "refuges"; controlled existence; so-many-per-acre.

There can be no finger of shame to point. The destroying white man, a product of Nature as much any other earthly thing, has two sides to him. The one is the beast-of-prey, which for natural reasons seeks to destroy; the other is the Godlike Wisdom, which seeks to construct.

Hence, the antelope was eliminated to such a large extent because it was his destiny. He played no part in the construction of civilization. Wherever the plow dug deep, and the barbed-wire fence rose from the ground the finger of fate pointed elsewhere for the Pleistocene antelope, and said, "You've had your day. Move on."

On the newly-created prairie farm the story was read along the fences, where the antelope collided head on with barbed wire. Alas, Nature had never taught him to jump. On the level plains floor there was no need for it. Then, of course, there was always the gun.

Elsewhere, where barbed wire was lacking or far apart, the story was a little different. It was sheep—to a large extent—and, of course, guns. No matter what the details, the general facts remained the same. It was civilization versus the antelope; the recent versus the Pleistocene.

Finally, at a time when it seemed that the pronghorn antelope was about to follow the dim trail of the camel and the horse, the white man raised a halting hand to the

carnage. His constructive side rebelled. Words were spoken. Deeds were done. Hence, the antelope is still with us.

Today, the antelope has increased. It is no longer in great danger of total extinction. Increases, however, are largely local. Civilization's demands are such that its former range can never again be achieved. It will probably never see Kansas again. In the Dakotas, Nebraska, Oklahoma, Texas, Colorado, and Utah the animal is in serious straits, and in no little danger of extirpation. At present a restocking experiment is under way in the State of Washington, where the pronghorn never roamed much at any time. That state took measures to introduce the animal to Washington's desert areas only last summer by the importation of young, captured stock from the Charles Sheldon National Antelope Refuge in Nevada. The Desert Game Refuge in southern Nevada has been similarly stocked. These are interesting experiments, for to date the antelope has been highly indifferent to artificial restocking methods.

In the remaining western states the antelope has made appreciable natural increases. Wyoming has the largest herds of any of them. Montana, Idaho, Oregon, New Mexico, California, and Nevada are "catching-up," and Arizona also, although more slowly. But, antelope increases are mockery from a biological point of view, made as they are for the purpose of reducing the surplus.

The antelope is of interest to the plant ecologist, as well as the animal ecologist, owing to the difficulty of separating plant ecology from animal ecology in a practical sense. In ecology, which is the study of the relationships between an organism and the sum total of the factors of its environment, North America has been divided into life zones according to annual mean temperatures, and some life zones further divided according to rainfall. The so-called Upper Sonoran zone of the western United States and similar parts of Canada, occurs generally in the lower valleys and flats as far south as southern Nevada, where it gradually merges into the so-called Lower Sonoran, characterized by a higher annual mean temperature than in the Upper, and a higher rate of evaporation, all of which results in a peculiar flora vastly different on the whole from that of the Upper Sonoran. The Lower Sonoran is generally characteristic of the southwestern United States and northern Mexico.

The Upper and Lower Sonoran Life Zones contain by far the most of the pronghorn antelope range, provided the view is unobstructed by tall brush or boulders. Temperature, it would seem, may limit the form of dominant vegetation, but not the range of the prongbuck and many of his mammalian associates.

Some of the largest herds of American antelope still roam over the Upper Sonoran low sage flats of southeastern Oregon and adjacent Idaho and Nevada. In this area the antelope is receiving no little attention from the Biological Survey and the Oregon Research Unit, a cooperative research activity at Oregon State College. The ecology and life history of the antelope are here receiving a thorough going-over under the supervision of a trained biologist. It is also in this region that the two largest and almost strictly antelope refuges in the country have been created. The one is the Hart Mountain Antelope and Mule-Deer Refuge in Oregon, and the other the Charles Sheldon Antelope Refuge in Nevada. The two areas are barely across the state line from each other, and as a matter of fact the latter seems to be to a large extent winter range for the former.

The Upper Sonoran grasslands east of the Rockies, especially the shortgrass plains, once supported millions of antelopes, and even today the Wyoming prairie abounds with a goodly number. For the larger part, however, the prairie antelope has been sacrificed for the dry farm and the dust-bowl. On the arid Lower Sonoran plains of the

Southwest and old Mexico they form an interesting foreground to an interesting background of grass and an occasional soaptree yucca.

Evidently, the plain's the thing—for the antelope. He may pause at the foot of a mountain to make the acquaintance of a wandering mule-deer, but when "jumped" the casual acquaintances break in opposite directions. The deer whips about and bounds for the tall timber, whereas the antelope is off at a horse-like gallop for the plains. As might be expected, there are exceptions; some of the old-timers of the pronghorn species lean toward eccentricity, and it is really not a rare thing to jump old bucks summering by themselves on the windswept tops of mesas.

On the whole, however, the animal belongs to the sort of country that is seldom, if ever, visited by colossal trailers, billboards, and hamburger stands. So far as scenery is concerned, antelope country lacks it. By the strength of its nature it is still largely the land of the "broom-tail" horse, the sheep-herder, the cowboy with his reduced herds.

However, much of this country is not unpleasant, and none of it, from one point of view or another, is uninteresting. To me, the most pleasant antelope country I have ever been in is that area just north of Fort Collins, Colorado, adjacent to the Wyoming line. The land there is broken and rolling enough to offer variety. Its weakest point is its lack of good food. Prickly-pear is taking the country over.

Two years ago this spring I stood agape on the top of a shortgrass hill in that part of northern Larimer County, where antelope at one time were counted by thousands, and beheld for myself the straggling remnants of the prairie's vanishing biological glory. Seven antelopes formed the herd, and they ran with the speed that is their birthright against a background of open hills that rolled on and on to the north, into Wyoming. It was a vast, forlorn vista that was entirely empty except for those last antelope remnants that eventually became invisible to the human eye, swallowed by the immense open spaces of would-be grassland.

Gone, the sea of grass; gone, the shaggy-headed bison. Out of the entire whirl of the thundering plains life of yesteryear are these, the few straggling remnants of the pronghorn antelope, noble remnant from the Pleistocene.

Treasure Hunt

By LOUISE LEIGHTON

You set a treasure hunt for me.
The first clue routed me over a hill:
"A hunched brown dwarf took the form of a tree,
And knee-deep in mosses, stands very still."

I found the dwarf with a note in his hair;
It bade me travel a rocky space
Where boulders crouch in their ancient lair—
Once it was sea—now a sand-blown place.

I drew a white missive out of the sand:
"You must kneel," it read, "on a lichened log,
Invade the red-winged blackbirds' land,
And drink from a rainbow that colors a bog."

I found the marsh and the fallen bough,
And an iris flag with its lips held up.
"You are very close to the secret now,"
Said the words you left in the rainbowed cup.

"Haste to the river where currents swerve,
And pools of shadow reflect the shore;
The treasure waits in the greenest curve—
Oh, cherish it dearly, I implore!"

Not all the glitter the hills may bear,
Nor riches stored in the sea or the ground,
Could buy the treasure hiding there—
Oh, darling heart, it was you I found!

My Personal Forest

A newspaper editor buys a farm, asks Nature to go to work for him, and Nature does

By TOM WALLACE

TOM WALLACE SURVEYS HIS FOREST

A trail in a forest that Nature, unaided, grew on a bare field between 1910 and 1939. To cut the trail through the growth was a real task

"I WANT to deal with you frankly," said the real estate agent, "and I am not telling you it's a farm on which you can make interest. If you want a country place with a superb river view you can't do better."

The only thing the bride and I saw that was not run down, when we inspected the farm, was the river view. The farm was what now would be called sub-marginal as a whole. Thirty-five acres of it was low ground that was not ruined, although it had been "corned" steadily without cover crops.

The owner, a clergyman, was not, and did not pretend to be, a farmer. He rented his land to tenants who ripped from it what they could get, leaving it mangled.

After our first corn crop was harvested the crib fell down, and apart. The barn looked as if it might follow suit. We had it pulled down, lest we be guilty of killing the old buggy horse, Rozinante, and the cow, our first year farm animals. The corn that caused the crib to collapse was grown by a neighboring farmer on shares.

We decided to fence the farm. The low ground had been unfenced for many years—the hills nominally fenced. We would put cows on it, and restore it.

The home of a young farm hand a few miles up the river went down river on a flood. He was recommended to us. That was in 1911. This story happened since then.

Fifteen acres of hillside land, partly timbered, gashed by deep red gullies, had been repeatedly burned to keep down briars and broom sedge, and was called a pasture.

We never fenced it except to keep livestock out of it. On one side of it, bordering unused land, which afterward was bought as residence property, the fence was allowed to fall down.

We decided to let Nature take its course there. Three acres were fairly set in locust, young walnut, poplar and elm, which had grown up after such mistreatment of the land that a gully twelve feet deep and twenty feet wide crossed it diagonally.

Next the little woodland were two and a half acres of land called the Sand Point. This lay well enough for tillage but eroded shockingly when plowed, mainly because the gully, which began in a pasture on another farm, poured a torrent into it during hard rains.

My partner—I took the young man into partnership, as he preferred that to wages—wanted to keep hogs in the little woodland, but that would have made erosion worse. So we retired it from the farming operation. The two tracts thus withdrawn, plus a strip along each side of the entrance road running fifteen hundred feet up hill from low ground to residence, made about twenty acres. The farm was only eighty-seven acres at our best measurement.

NATURE TRANSFORMED
A ONCE BARE ROADWAY

In 1910 only an occasional tree grew along this roadside—perhaps a half-dozen in 1000 feet. Now there is such a scene at noon of a day in mid-summer—green leaves and cool shade

Our arrangement was not farming, practical farmers said. It was lunacy.

I told my partner to rent for cash land for growing corn and I would pay the rent. We cash-rented here and there, sometimes share-cropped. We broke and worked down land for others with our little Fordson tractor between jobs at home. My partner provided the labor. I provided the land. Sometimes we made hay on other farms on shares, while our Jersey herd increased, never by purchase after we bought the first three cows.

Eventually I bought adjoining, submarginal hill land until the farm was one hundred and fifty acres. My partner earned a livelihood from the start.

The tenth year, the farm still was eighty-seven acres. We share-cropped on eighteen acres of low ground, growing corn, and divided a net profit of twenty-four hundred dollars.

In addition each partner had chickens exclusively his own. Our chickens netted six hundred dollars. My partner had as many chickens, or more. If he netted as much, that was thirty-six hundred dollars net from eighty-seven long abused but now recovering acres, twenty unused, plus one half the crop on an additional eighteen acres, thirty-six hundred dollars net from one hundred and five acres.

In partnership we sold milk, pork on the hoof, table corn, tomatoes, beans and onions. Individually we sold broilers and eggs. Nowadays the hundred and fifty acre farm is still under Jerseys. My partner still raises chickens. We do not. Our hennery was abolished in 1920 because my (newspaper) business took me to Washington, and we had to close the house. We did not revive the hennery. My office work demanded my time increasingly, and the children demanded my wife's time.

Before I acquired sixteen acres north of our line I persuaded the owner—a commuter not interested in farming—to allow an acre next, and above, our barn lot to grow up to brush, elm, briars, weeds, to stop erosion there, and in the barn lot. It is now a charming grove, *sans* weeds and briars. A path leads through it to the tenant house. There is no longer a gully through the barn lot.

"The Sand Point" long ago became good land. The gully in the woodland, its upper end used as a trash dump, has been for some time on the mend. Its bottom is flat and spicewood bushes grow there and on its sides. From any woodland on the farm we take locust when we need it for posts, never deforesting.

The dense little woodland, like a French *bois* is highly ornamental. It has redeemed virtually its area of adjoining land. Neither tract would be worth anything had the woodland been used as a piggery since 1910.

The fenced-off strip along the entrance road now is widely considered one of the loveliest approaches to a residence in our county.

Practical-farmer neighbors said only scrub elms would grow along the road. Eventually the shade killed the briars and weeds. Trees of numerous species followed the elms when the leaf loam encouraged them. With the exception of a few dogwoods and redbuds recently planted, there has been no planting. Among the volunteer trees are ash, tulip, beech, hackberry, rock maple, black oak, and linden. Some of the ash and tulip are almost as large, and quite as straight, as telephone poles. In a dense stand, they reach for the sun. The elms are not "scrubs."

Through the fifteen acres, which was partly broom sedge and briars, partly trees, partly raw gullies in 1910,

VOLUNTEERS DO A FINE JOB ON THE WALLACE ACRES

These locusts contribute to checking erosion that was bad in 1910, and provide shade for the livestock in the summer when Kentucky's sun is warm and benign and efficient

I cut a trail this summer, using an axe, a briar scythe and a sheath knife. I longed for a machete or a bolo.

Humming-birds in jewelweeds, squirrels in the older trees, wood thrush and chewinks on land that was bare in 1910, were company for me as I hacked at the trail every afternoon between four-thirty and seven.

That trail, joining a trail through a ravine along the entrance road, makes a continuous mile of woodland trail on a hundred and fifty acre farm without an operating deficit in twenty years.

The gullies in the fifteen acres are no longer red. Two have almost disappeared. The third still is deep, but its bottom is flat and verdure-covered. It is no longer eroding.

Fifteen acres of real forest on a country place near a city probably is worth more than that much farm land. You cannot walk a mile of forest trail on every commuter's quarter-section.

Gullies on the land we added to the original eighty-seven acres are fenced to keep cows and horses from destroying anything that grows there. Some locusts and wild cherries were growing along the sides of the gullies. Now each gully is hidden by a good stand of trees, black locust predominating. Undergrowth makes ideal bird sanctuaries. Livestock require shade in summer. They do not have to enter groves to get it. There is shade on one side or the other of one grove or another at any time. A farm with forest and groves in its pastures is more practical than one wholly denuded, if it is a farm in such condition, that it needs trees so sorely.

Where Nature, unaided, is your forester, fire risk is caused by weeds and briars until shade becomes sufficiently dense to obliterate them, and many trees that Nature grows are what foresters and lumbermen call weed trees. The advantage of leaving everything to Nature is that you avoid cost of scientific afforestation.

Our farm, when my wife and I began living upon it in 1910, required, to make it practical, a tenant house, a barn, silos, a corn crib, a milk house, a few miles of fence, livestock, implements, machinery, fertilization.

Our home—a quaint century-old log house with a stone chimney at each end and four wood fireplaces—required, to make it habitable from our point of view, an addition, central heat, electric lights, piped water, an adequate water supply—developed finally through drilling a well in the valley field and piping the water two thousand feet—and babies. All of this would cost money.

So, instead of afforesting the torn and bleeding parts of the farm, we let Nature do it. And Nature did it.

•

A Forest Trail Goes Winding Through My Heart

By MARY DICKERSON BANGHAM

A forest trail goes winding through my heart—

Song of a wood-thrush, like a silver bell,
A dark-eyed daisy near some hidden spring,
Lonely wee wild-rose by a mossy dell,
Where hick'ry smoke from near-by camp-fire brings
Its fragrant air;

Glimpse of a lake, a sky that sifts its blue
Through leaves of early morning—silver-green;
World that holds a thousand cups of dew!
One in each flower-center; and the keen
Cool woodland air.

A forest trail goes winding through my heart,
On city streets I tread its paths—apart.

To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

Jupiter, Saturn and the Earth

By ISABEL M. LEWIS

THE two largest planets of the solar system, Jupiter and Saturn, are both to be found at this time in the inconspicuous constellation of Pisces, and are visible in the southeast shortly after sunset. Jupiter is easily identified because it is surpassed in brightness only by Venus, which is in the southwest in the early evening, setting within two hours of the sun. In color Jupiter is a deep yellow and its light is remarkably steadfast and unflickering, more so, it appears, than that of any other planet. Saturn, which lies some distance to the northeast of Jupiter, is much paler in hue, and is about equal to the stars Capella or Rigel in brightness at this time. Both planets will be in excellent position for observation in the evening. Until toward the end of the month, Jupiter will be above the horizon until after midnight. It will be in quadrature with the sun on December 22, when it will be due south at sunset. Saturn, because it is so much farther east and to the north of Jupiter, will set considerably later in the evening.

Compared to either of these great planets the earth is a dwarf. The diameter of Jupiter is nearly eleven times that of our planet. From its huge bulk could be fashioned 1312 worlds the size of our own. Both in bulk and mass, Jupiter is, in fact, greater than *all the other planets combined*. Saturn has a mean diameter about 15,000 miles less than that of Jupiter and about nine times that of the earth. It is equal in size to about 734 earths. Although the ball of Saturn is considerably smaller than Jupiter, its unique appendage of three concentric rings made up of countless tiny moonlets adds greatly to its apparent size in the telescope. The width of the outer ring is about 10,000 miles, and it is separated from the central and brightest of the three rings by a narrow gap about 3000 miles wide, known as Cassini's Division. The width of the central, bright ring is about 16,000 miles. It, in turn, is separated from the innermost or crape ring, as it is called, because it is so feebly luminous, by a narrow gap

about 1000 miles wide. The crape ring is about 11,500 miles wide, and there is an open space of about 7000 miles between the inner edge of this ring and the surface of the planet. The width of the whole ring system, then, is about 41,500 miles and the distance from the outermost edge of the outer ring on one side of the planet to the outermost edge on the opposite side of the planet is 171,000 miles. The thickness of the ring system is believed to be less than ten miles and the individual tiny moonlets of which it is composed cannot be at the most more than three miles in diameter. They may be much less. Such is the remarkable ring-system of Saturn, which has no counterpart in the solar system, or, so far as is known, anywhere else in space.

Our planet, Earth, is remarkable because in proportion to its size, it is the heaviest body in the solar system, with a density five and one-half times that of water. Saturn, on the other hand, is the lightest of all the planets, with a density only seven-tenths that of water. It is therefore light enough to float in water. Jupiter has a density slightly less than that of the sun or about 1.3 times that of water. So, while our planet has a surface crust and is generally believed to be solid throughout, these two great planets are largely, if not entirely, gaseous. Although they may have small central cores, most of the phenomena that are observed, if not all of them, arise in their dense atmospheres, such as the great belts varying in width and number from year to year that lie parallel to the planet's equator and are plainly atmospheric in their origin. The belts of Jupiter are much more distinct and interesting to observe than those of Saturn because the planet is, on the average, about 400,000,000 miles nearer to us at opposition. The surface of Jupiter is, undoubtedly, more interesting to observe telescopically than that of any other planet.

There is an infinite variety of detail on the disk; cloud-like formations, rich in color, mostly red, brown, and green. These appear, at the great distance of the planet, as small spots, but actually are many miles in extent and frequently pass one another with relative velocities as great as 200 miles or more per hour. From observations of such markings it has been found that the planet rotates on its axis at different rates in different latitudes and more swiftly than any other planet. A great equatorial current rotates in 9 hours 50 minutes, but outside of this belt the rotation is about five minutes longer. Saturn rotates similarly at different rates in different zones but its rotation period is longer than that of Jupiter, being about 10 hours 15 minutes at the equator. Our own small planet, of course, takes 24 hours to turn once on its axis.

In addition to the transient markings on the surface of Jupiter, which may last for days or weeks, there are markings of a semi-permanent nature such as the Great Red Spot of Jupiter. This is known to have existed for nearly one hundred years at least. It changes greatly in color from time to time. It has been brick-red, pale-pink, and again has disappeared completely as if covered by overlying clouds. Yet even when invisible the notch, or hollow, in which it apparently lies, on the border of the South Equatorial Belt, is clearly outlined. It is about 30,000 miles in length and 7000 miles wide and roughly oval in shape. It is believed to be associated in some way with electrical or magnetic forces as it seems to have a repellant action upon surrounding matter. Although it lies in the Red Spot Hollow it is separated from its borders by a clear space. In contrast to its general repulsion for its surroundings it possesses a noticeable attraction for another most remarkable feature of the planet's atmosphere and that lies in the same latitude as the Red Spot. This is known as the South Tropical Disturbance. First noted in 1901 as a dark protuberance from the south edge of the south equatorial belt, it extended rapidly in longitude until, with the white spots preceding and following, it became a most conspicuous feature of the planet's surface. Since that time there have been many interesting observations made of the effect of these two markings upon one another, and much has been written about them. Although they appear to be drifting in an equatorial current at different rates of rotation, it appears that after every conjunction of the two the Disturbance loses velocity as if it were retarded by the influence of the Great Red Spot. The nature and origin of these two phenomena are still a mystery.

Our planet has but one satellite, the moon. Jupiter has eleven satellites, two of them small objects, probably not more than 25 miles in diameter. These were discovered by Dr. Nicholson at Mt. Wilson in 1938 as a result of a photographic survey of the region around Jupiter. Saturn has nine. These satellites vary in size from bodies more than 3000 miles in diameter, and comparable in size to the planet Mercury, down to objects comparable in size to small asteroids. Titan is the largest satellite of Saturn. Phœbe, the ninth satellite of Saturn, and its smallest, is less than 200 miles in diameter. The phenomena of Jupiter's four historic satellites, known also as the Galilean satellites because they were discovered by Galileo in 1610, their occultations, transits and eclipses, add greatly to the interest of observing the giant planet. Mimas, the nearest of the satellites of Saturn to its surface, skirts along the rim of its outer ring at a distance of only 30,000 miles from it. Titan, its largest satellite, is easily visible in a three-inch telescope.

The planet Mars is still conspicuous in the evening sky in Aquarius. It is moving rapidly eastward among the stars, and by the end of the month is near Jupiter and to the southwest of it. Venus is conspicuous in the southwest in the early evening, and Mercury reaches greatest western elongation in the morning sky on December 16. Winter will begin on Dec. 22 at 1:06 P.M., Eastern Time, when the sun will be farthest south.

A Poetic Engineer

William T. Jones of Wind Gap, Pennsylvania, is a locomotive engineer. His runs take him over the countryside in Pennsylvania and New Jersey, and he writes that from "my duties in the swaying cab of a huge locomotive I find time to observe and marvel at the change and beauty in Nature as the seasons march on. I was so impressed by the wonderful coloring of the hills that I was tempted to express what I felt by writing about it. But please remember that I'm not a writer."

This is what he wrote, under the title "The Year Goes By", and we wish we could do as well:

The year grows old with beauty bold;
Time paints the trees and vines;
The sumach's blaze, the hickory's gold
Against the splendid pines.

The leaves fall softly, slanting down;
The streams grow dark and still,
While corn shocks bivouac, line on line,
Where pumpkins dot the hill.

The red clad hunter stalks the wilds
Where timid creatures lie.
A bluejay screams his warning.
The novice passes by.

The snow falls thickly, soft and deep.
The birds wing South. The year's asleep.

Journals and the War

The non-receipt by a subscriber of any European chemical or other scientific journal seriously needed as research material should be promptly reported to the American Documentation Institute. The Cultural Relations Committee of ADI, which cooperates closely with the Cultural Relations Division of the Department of State, is working on this problem, and hopes to be able to surmount such war obstacles as interrupted transportation, embargoes and censorship, which so grievously affected the progress of research during the last war.

The principle should be established, if possible, that the materials of research having no relation to war shall continue to pass freely, regardless of the countries of origin or destination. Reports, with full details of where subscription was placed and name and address of subscriber, volume, date and number of last issue received, should be addressed to: American Documentation Institute, Bibliofilm Service, % U. S. Department of Agriculture Library, Washington, D. C.

Australian Adventures

Koonwarra is the title that Charles Barrett gives to his book of naturalist wanderings in Australia and neighboring islands. The title is taken from the aboriginal words meaning black swan, one of the striking and interesting examples of the fauna of the Antipodes. While there is much adventure in the book, the author's attention is primarily directed toward the flora and fauna of the regions he visits, making a volume of entertainment and information. It is grand reading. The book is published by the Oxford University Press, and sells for three dollars.

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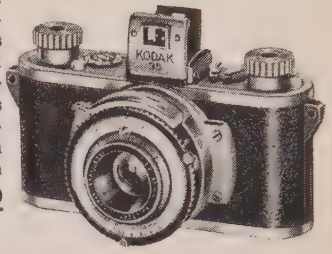

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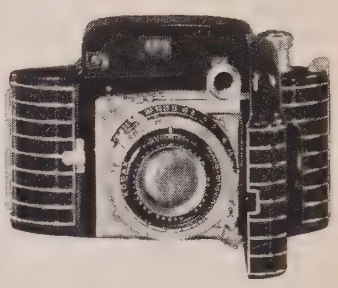

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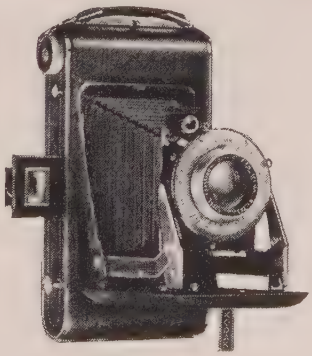

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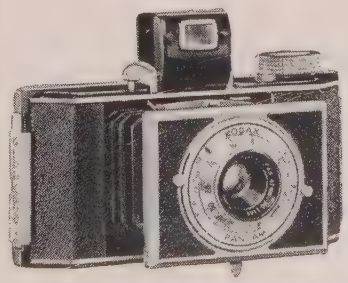

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ONLY EASTMAN MAKES THE KODAK

THE SCHOOL PAGE ★★★

EDITED BY DR. E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

Studying Domestic Mammals

The insert on Domestic Mammals in the center of this number of *Nature Magazine* provides many facts that should be useful to teachers and others interested in studying domestic mammals. The insert, however, gives relatively little advice on how this material might be used in the classroom.

With world conditions changing so fast, it would be well if notebooks be kept either by the teacher, by interested pupils, or by committees of a class that would show changing interest in the work of domestic mammals. Since the insert was prepared, considerable interest has arisen in the requests of foreign nations that we ship them domestic mammals for use in war. These demands have met counter-demands from our army men who feel that we may need, for our own purposes, all that we are likely to be able to raise in the relatively near future. We cannot produce serviceable draft animals as quickly as we can rifles nor can we hurry appreciably the processes by which they are produced. Representing another viewpoint, our humane societies are requesting our national authorities not to ship dumb animals to centers of warfare because of humanitarian reasons. Here are three interests involved in possible use of domestic draft animals. How do the children feel the situation should be met?

The opportunity cannot be passed to recommend that teachers far and wide procure for classroom use the first reference quoted on page 580 dealing with livestock and mythology. It raises all sorts of interesting issues that should lead to profitable classroom activities. Its study should help geography teachers understand the attitudes of peoples of different parts of the world and possibly to understand the prejudices of local peoples of exotic extraction. World maps might well be prepared to show the attitude people have towards different kinds of domestic mammals and some studies might be made of local beliefs associated with religious convictions as they bear on the eating of flesh-producing creatures.

Health is always considered in a well organized school program and domestic mammals have their contribution here. Since the present insert was prepared, it has been announced by the United States Public Health Service that the rat is susceptible to infantile paralysis and may possibly be the reservoir from which epidemics develop. It has been found that the eastern cotton rat may contract the disease and since this is the case this rat may displace the Rhesus monkey as an experimental animal in the study of this dread disease. It had been feared that research on the disease might be seriously impaired by the war and religious prejudice that would interfere with the wholesale importation of these monkeys. The announcement in September of the use of the rat as an experimental animal changes the situation. Monkeys cost from 8 to 25 dollars each and require years to reach a point where they may be of experimental value. Rats cost much less and mature much more quickly. Besides, their more remote relationship to man somehow changes our sympathy for them. Infantile paralysis epidemics will continue to arise, as will epidemics of other diseases. Children in our schools can and should be reasonably informed on many of the ways in which these epidemics arise. Reference to good literature on health should help the children understand the role domestic mammals play in disseminating disease and in controlling it.

Sex education may be sanely advanced through understanding the reproductive techniques of domestic mammals. The data given in the insert under "life history" should be generally significant in this connection and useful observations leading to understanding of problems in genetics may be found in seeking in the hybrid mules the characteristics possessed by the jack fathers and the mare mothers. How man has used this knowledge of genetic principles is shown in the unit "use to man" where breeds of such animals as pigs, sheep and dogs are discussed. This should well lead to recognition of the varied abilities possessed by local domestic mammals, of the dogs that excel in smelling, of those with superior speed, and those with exceptional intelligence. The techniques whereby these strains of animals have been produced may be duplicated by children desiring to improve their pets from generation to generation.

Studies in physical science may be made by studying the bodies of animals to see how they vary in their ability to do work and why these variations are important. It might be thought-provoking to ask the children such questions as the following: What abilities are possessed in common by the domestic mammals which eat an essentially plant diet? What limitatons do temperatures in different parts of the world place on the domestic mammals to be found there? Which, if any, of the domestic mammals are more active at night than in day and how do their eyes vary? Are the ears of plant-eating domestic mammals likely to be more movable than those of the flesh eaters, and why? How do the coats of domestic mammals vary in different seasons of the year, and do these changes take place as conspicuously if the animal is kept confined in a warm shelter or forced to exist exposed to severe weather? When the fur of domestic animals is rubbed does it vary in its tendency to produce sparks in accordance with varying weather conditions? What effect does rubbing the fur the "wrong way" have on the emotions of the animal?

While most of the above questions may be answered by reference to literature it would be better to use direct experience where this is possible. These direct experiences might well lead to simple experiments to test the varying ability of domestic animals to show intelligence. Do they seem to "learn from experience"? Do they have a "sixth sense" that makes it possible for them to detect deception on the part of their guardians or are they consistently gullible victims to their desire for a good meal? Do the local domestic animals have ample means of indicating that they are in pain and can such emotions as fear, hatred, joy, hunger and boredom be read safely into their actions? Which, if any, of the domestic animals available for study will ever voluntarily sacrifice their own comfort and convenience for man? Which will risk their own safety for the protection of their own young? Which will act cooperatively for the benefit of others of their kind? Which are essentially solitary animals satisfied completely with their own company so long as they are warm and well fed, and which seem to require companionship of other animals of their own kind? Which, if any, favor companionship with animals not of their own kind to that of animals of their own kind? Will a dog prefer the companionship of man to that of another dog, and if this varies when does it vary? Dogs may fight other dogs for the protection of sheep to meet the reward they may get from man; but is it more usual for animals of a kind to work together for the interests of their own kind? While a cow may show concern for her calf when her udder is full does she show equal concern when she has been milked and relieved of her own personal discomfort?

Other behavior studies of domestic animals might center around questions of protection. Which available for study use their front limbs in defense and which the hind? Which use their teeth to protect themselves from their enemies and which depend almost entirely upon escape or make no defense? In what ways are the teeth, feet and other parts of the body suitable for defense and for offense? How do horses and cows differ in the way in which they rise from the ground? What is the typical behavior of a dog before it lies down? Does a cat descend a tree as does a squirrel?

Studies made of domestic cattle show that they will normally spend not more than eight hours a day in gathering food. The remainder is spent in chewing the cud and in resting. Knowing this, wise farmers offer the cattle forage not much in excess of six inches in height to the end that the cow may stow away for use in flesh or milk production a maximum of food in the eight working hours. Breeders of beef cattle have developed animals with broad lower jaws which permit the animals to take in more food per hour than competitors with narrow jaws and as a result the animals have more food to turn into beef. It may seem strange to the layman that little things like these are worthy of study but they have yielded phenomenal results to those with patience and intelligence to make them.

Of course the economics of domestic animals is highly important. When it is proposed that Argentine beef be imported to feed United States soldiers while United States cattle do not bring a suitable return to our farmers, excitement starts. Should our army be fed at the lowest possible cost from a world market while local cattle are being purchased by the tax payers' money to support our citizens on relief? Will not such practice increase our domestic relief roll because of the economic failure of our stock raisers? To what extent are we justified in sacrificing local interests as a nation for the sake of winning economic coopera-

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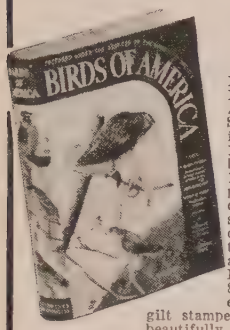

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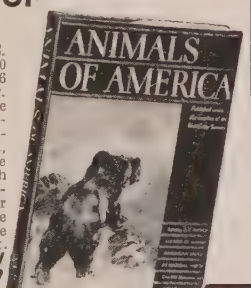

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tion with South American countries while Europe is at war? This is only one of the puzzling problems dealing with domestic animals on which public servants will make decisions and on which all citizens of voting age should be able to form intelligent judgments. School studies of domestic animals wisely handled will be far from mere busy work but may constitute superior training in citizenship.

More Herpetologists

Two more young men come forward with the request that their names be added to the list of those wishing to correspond with others interested in herpetology. They are Elver Barker, 1083 West 35th Street, Los Angeles, California, Bob Jewell, 131 East Moore St., Flint, Michigan, and Francis T. Nicholson, R. D. No. 4, West Garden Road, Vineland, New Jersey. The other day one of our members who was thus listed wrote that he was already corresponding with twelve other amateur herpetologists reached through these columns.

Garden Book

In the more than twelve hundred pages of the volume entitled *America's Garden Book* is packed an amazing amount of information for the gardener. The title suggests that this book is intended to be the final word in garden books of general character, and the publishers, Charles Scribner's Sons, describe it as the "most complete garden book ever published". It is the work of Louise and James Bush-Brown. A careful scrutiny of the table of contents suggests that the claim of the publishers is no vain boast and that the three and one-half dollars asked for this volume is a fine investment for any gardener.

INDOORS AND OUT

(Continued from page 551)

peals to me very much. The volume would be more useful if it included a chronological list of the events in Thoreau's life. It does include all the other helps and is well illustrated.

Mr. Canby reflects not only the general consideration of Thoreau's works as two-sided but also exemplifies the current tendency to stress his importance as the philosopher of the individual. An earlier generation overlooked this almost entirely and thought of Thoreau as the poet-naturalist. It seems to me that Thoreau's outdoor experiences are central in his life and that an excellent biography could be written on this theme. Thorreau is especially timely now because of what he has to say about our pressing problem of how to be ourselves in a complicated society, but it seems to me that his answer comes largely out of his outdoor experiences and I rather believe that in the long run he will be remembered best as a "reporter of the universe."

Of course there is no substitute for Thoreau's own writings; a "life" without "works" is not enough. Mr. Canby's biography is uniform in binding with his one-volume selection of *The Works of Thoreau*, published by Houghton Mifflin Company two years ago for five dollars. These two volumes constitute a prize possession, and this suggestion may solve someone's Christmas problem.

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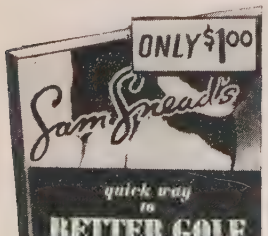

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On The Air

Radio broadcasting being, in some ways, almost as uncertain as the theatrical business, particularly in these troublous days, it is not very safe to make any long range announcement of program schedules, especially with regard to sustaining features. There are, however, several programs on national networks that are of interest to those concerned with Nature, Science and Conservation, and which hold fair promise of being regularly presented. Eastern Standard Time is given in each instance.

THE WORLD IS YOURS—Presented Sundays from 4:30 to 5:00 p.m. over the red network of NBC. Under the auspices of the Smithsonian Institution and the U. S. Office of Education. Science and Conservation.

AMERICAN WILDLIFE—Presented Sundays from 12:45 to 1:00 p.m. over the Mutual Broadcasting System. Under the auspices of the American Wildlife Institute. Conservation from the sportsman's viewpoint.

SCIENCE ON THE MARCH—Presented Mondays from 7:45 to 8:00 p.m. over the blue network of NBC. Under the auspices of the American Association for the Advancement of Science. Science.

NEW HORIZONS—Presented Wednesdays from 9:15 to 9:45 a.m., E.S.T., and from 2:30 to 3:00 p.m., Central and Pacific Time, and 1:30 to 2:00 p.m., Mountain Time, over the Columbia Broadcasting System. Under the direction of Roy Chapman Andrews. Science and Geography.

ORDER OF ADVENTURERS—Presented Fridays from 8:00 to 8:30 p.m. over the blue network of NBC. Authentic stories of adventure and exploration.

WHAT PRICE AMERICA?—Presented Saturdays from 1:30 to 2:00 p.m. over the Columbia Broadcasting System. Under the auspices of the U. S. Department of the Interior. Conservation of natural resources.

We would be interested to hear of any regular local broadcasts—or those sent out over smaller chains—in order that we may list all programs in these fields of interest.

Says a Little Indian

E—yeh—shurè is the name of a Pueblo Indian girl. In English her name means Blue Corn. She lives in a pueblo in New Mexico, and in *I Am a Pueblo Indian Girl* she tells how she lives, what she wears and eats, and what she does. This is her story, simply and directly told. With an introduction by Oliver La Farge, and with illustrations in full color, reproduced from originals by Indian artists, this is an attractive book for the younger set. It also will interest many adults. It is published by McMorrow, and sells for $1.50.

Glacier Park Popular

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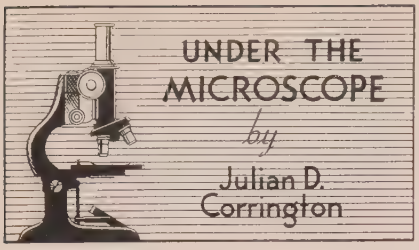

Bacteria

When the famous Dutch amateur microscopist, Antony van Leeuwenhoek, wrote a letter to the Royal Society of London on September 17, 1683, he could not have foreseen that some of the descriptions and illustrations he included were destined to stand as foundation stones of a great modern science—Bacteriology. This communication appeared the following year in the *Philosophical Transactions* of the Society, and constitutes the first published description of bacteria, including all three of the structural types recognized today—the rod-shaped bacillus, the spherical coccus, and the corkscrew spirillum.

Leeuwenhoek's experiment is still repeated in thousands of biology classes, both high school and college, throughout the world every year.

"Though my Teeth are kept usually very clean," he wrote, "nevertheless when I view them with a Magnifying Glass, I find growing between them a little white matter as thick as wetted flower (flour); in this substance tho I could not perceive any motion, I judge there might probably be living Creatures.

"I therefore took some of this flower and mixt it either with pure rain water wherein were no animals; or else with some of my Spittle (having no Air bubbles to cause a motion in it) and then to my great surprise perceived that the aforesaid matter contained very many small living Animals, which moved themselves very extravagantly." (Quoted from Locy, *The Story of Biology.* Henry Holt.)

Leeuwenhoek's "Animals" were no more than curiosities for a period of almost two hundred years, and it remained for Louis Pasteur, in 1878, to explain the vast importance of these insignificant organisms to an astonished and incredulous world, and to found bacteriology as a science, with many intricate techniques all its own. At first so much emphasis was placed on the species producing diseases in man and his domestic animals that modern followers of Pasteur, Lister and Koch are constantly at pains to show the general public that not all bacteria are harmful; that some, indeed, are beneficial and even necessary for human existence.

For mankind has so evolved as to develop immunity and live in harmony with many kinds of bacteria, a point strikingly brought out in H. G. Wells' *The War of the Worlds,* in which hypothetical men from Mars attacked our planet. They were making great headway and rapidly subduing England when, suddenly, all of them died—killed by bacteria, among the lowliest of earthly creatures, yet presumed in the story never to have evolved on our sister planet. Hence Martians had never acquired any immunity to species harmless to mankind, and so fell speedy and easy victims.

Today we know the bacteria to be one-celled plants, constituting the simplest group of the Fungi. Like all of their relatives they lack chlorophyll and hence cannot manufacture their own organic food as do the green plants. They must live by breaking down simple inorganic compounds, or upon dead organic matter (saprophytes), or attack living beings (parasites). They comprise the Class Schizomycetes, or Fission Fungi, since their method of reproduction is by splitting in two (fission) rather than by the formation of spores, as with higher Fungi. Some bacteria have a "spore" stage, but these are resting bodies to tide over unfavorable periods, and not reproductive in function.

Organization in the bacteria is simple. Usually there is no sign of a nucleus, the nuclear material being finely distributed throughout the cell protoplasm. The cell wall may swell up to form a capsule in some species, while others go through motile stages, producing one to many long hair-like processes, flagella, which act as whip-lashes and propel their owners through water or other liquid media. The dried-up spore stage is the form in which bacteria are found in the atmosphere, and these bodies are very resistant, surviving even boiling for hours at a time.

Bacteria occur as independent single cells or, following fission, the daughter cells may remain attached so as to produce certain characteristic forms with names familiar to the general public in this science-minded age. Thus a group of two spheres is the typical growth habit of diplococci; chains of spheres are termed streptococci; masses shaped like a bunch of grapes are staphylococci; geometrical packets are sarcinæ. The professional jargon of hospital laboratories shortens some of these—as "strep" and "staph." Some of the rods (bacilli) grow in chains also.

Originally the bacteria were soil organisms, and many vitally necessary species are found in all fertile soils. In fact, their work is essential for the preparation of any soil that will support more than the scantiest plant life. Rains wash them into streams, and the bacterial count of fresh waters rises after storms. Both the exterior and the interior surfaces of the bodies of higher plants and animals provide excellent sites, and in the warm moist cavities of higher animals, such as the mouth and intestines of man, conditions are optimum for a tremendous development of bacterial floras. Hundreds of millions of these cells occur in one gram of manured soil, sewage-polluted water, or the mucous membranes lining various cavities in the body, while many millions of millions may be found in one gram of human feces.

In size bacteria vary between a small sphere less than one micron in diameter up to a giant spirillum fifty micra in length. Under favorable conditions a bacterial cell can reproduce every twenty minutes, forming two cells, which then grow and divide again. Needless to say, but a brief interval of time is required for one, or a few cells to become millions, illustrating the ease with which dangerous pollutions or infections may be acquired by a soil, a body of water, or a living organism. The good or the damage that these microscopic plants can do is correlated, among other factors, by the prodigious numbers of individuals that may quickly arise.

The activities of bacteria are out of all proportion to their size, and consist of an attack on a great variety of substances with the general result of *decomposition.* Complex compounds are broken up into chemically simpler constituents, as when soil bacteria break up ammonium compounds, first into nitrites and then to nitrates, in which form the nitrogen is available for use by growing plants. Other soil bacteria capture free nitrogen from the atmosphere and make it available, and the farmer is today able to inoculate his soils with these useful species, or to plant legumes on the root nodules of which they occur.

The decay or *putrefaction* of dead organisms is a bacterial action, decomposing such

LEFT, GIANT SPIRILLUM STAINED FOR FLAGELLA. CENTER, STREPTOCOCCUS IN A MILK SMEAR. RIGHT, TUBERCLE BACILLUS IN A SPUTUM SMEAR

nitrogenous substances as flesh to form simpler compounds, with the attendant release of foul-smelling gases. Carbohydrates have their sugars decomposed by bacteria in the process of *fermentation,* yielding acids, as in the souring of milk. The pathogenic or disease-producing species liberate powerful *toxins* in the body, which are highly poisonous and produce the characteristic symptoms of such diseases as tuberculosis, cholera, diphtheria and typhoid.

Certain bacterial inhabitants of the human large intestine are considered beneficial, or even necessary for life, and obviously the world would long ago have been deprived of sufficient carbon, nitrogen and other elements locked up in the dead bodies of countless past generations of plants and animals were it not for the release of these elements by the bacteria of decay. Life on earth for all the higher organisms may justly be said to be made possible by bacteria.

In addition to agriculture, many important industries owe their existence to these minute plants. The retting of flax and hemp, curing of tobacco, digesting the seed coats of coffee and cocoa beans, tanning of hides, and the manufacture of butter, cheese and vinegar are all bacterial processes. Crop rotation and sewage disposal are other human inventions of major importance that put bacteria to work. On the other side of the ledger, aside from pathogenic species, we must wage a ceaseless war on those forms that spoil our foods and necessitate the pasteurization of milk and the canning and preserving of countless items of the modern larder.

Next month we plan to describe for you the methods of culturing bacteria for purposes of study, and follow this by the technique of making permanent stained slide preparations.

Vocabulary

Many of the terms used in connection with bacteriology are often loosely or incorrectly applied. Their proper meanings should be understood by the microscopist.

Microörganism, written with or without a hyphen, is the most inclusive of these group names, and denotes any organism, plant or animal, of microscopic size, whether or not pathogenic.

Microbiology is the study of microörganisms. Recently the word has been appropriated by bacteriologists to include only the bacteria, yeasts and molds, and to exclude all microscopic animals, but incorrectly and without any authority for so doing.

Microbe, from mico and bios, small and life, originally meant any microörganism, but by popular usage is now restricted to pathogenic forms. There is no authority for making this word synonymous with bacteria only.

Germ is a word of many meanings in biology, primarily having to do with reproduction, as germ cell, germ plasm, germination and the like. As used in medical fields it is a popular equivalent for microbe, as in the term *disease germ.*

Pathogen, any organism causing a disease. Commonly restricted to microbes and excluding such large forms as tapeworms.

Bacteria, a class of plants, all microscopic but by no means all pathogenic. Microbe, germ and pathogen are more or less synonymous with each other, but not with bacteria. They include those viruses, bacteria, yeasts, molds, protozoa and microscopic worms that produce diseases, but exclude members of all of these groups that are non-pathogenic.

Bacterium is a word with two usages. It is the singular of bacteria and as such may be applied to any member of the Class Schizomycetes. It is also the scientific name of a single genus of bacteria, as seen in *Bacterium pneumoniæ,* technical name of the pathogen causing bronchial pneumonia in man.

Bacillus likewise has two usages. As the singular form of bacilli, it may be applied to any rod-shaped bacteria. In addition it is the name of another genus, as in *Bacillus anthracis,* the pathogen of anthrax. Both of these words form compounds of frequent use in naming genera, such as *Mycobacterium, Lactobacillus* and many others.

News and Notes

Bausch & Lomb announce the resignation of Roy G. Walker, head of the company's department of Specialty Sales, which division controls the marketing of amateur microscopes and accessories. Mr. George G. Tschume, head of Photographic Lens Sales, has been named to succeed Mr. Walker, in a step to combine the two departments under a single management. William A. Gardner is assistant in photographic lenses, John F. Brandt in specialties, including binoculars, spotting scopes, telescopes, magnifiers, film viewers and many other commercial and military products, in addition to those for amateur microscopy. Our best wishes go to all of these gentlemen in their new assignments and positions.

The microscope is appearing before the public eye at an increasing rate and in every sort of medium. In addition to many technical shorts, there have been a number of feature motion pictures in which our instrument has been assigned a prominent rôle, such as *The Life of Louis Pasteur* and *From Headquarters.* Advertisements stressing the research accompanying manufacture of dentifrices, cosmetics, foods, drugs and many other products have for a long while played up the white-frocked scientist gazing into his optical assistant. Even the comic strips have not been immune to the general popularity of scientific equipment, and we have seen both Donald Duck and Dick Tracy qualify as expert microscopists.

The multiplicity of types of cover glass is perplexing to the novice. They have different shapes—rectangles, squares and circles. The rectangles are used for objects an inch or more in length or for series of objects; circles for neatness and wherever ringing or sealing of the mount is necessary or preferred. They differ in size, ranging in the case of squares and circles from one-half to one inch, in steps of one-eighth inch. They vary in thickness, the thinnest designated as O, then I and II. And of course they vary in quality and composition. We recommend non-corrosive, three-fourth-inch squares and circles, thickness I. In general, the smaller and thicker types are the cheapest, and squares are considerably less expensive than

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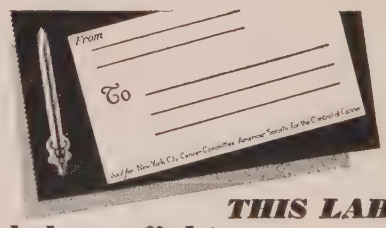

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circles. Cover glasses are sold by the ounce in ½-ounce packages; hence smaller sizes are cheaper because there are more separate covers to the package.

Not all cells are complete cells. The red blood corpuscle of mammals, for example, has no nucleus. The embryonic red blood cell (erythroblast) is a normal nucleated cell, but the nucleus is lost during development to the adult state (erythrocyte).

For those who have passed the beginning stage and wish some detailed instruction in the difficult art of making really fine photographs through the microscope, we endorse *Photomicrography,* a compact volume of 122 pages, handsomely illustrated in color and halftone, the 13th edition of which has been received from the publisher, the Eastman Kodak Co., Rochester, N. Y. We can think of nothing that has been omitted. There are sections on ordinary, color and motion pictures by transmitted, incident, dark-field and ultraviolet illumination; use of filters and biological stains; theory of photography and of the microscope; developing and printing; with reference lists and formulae. Order from the publisher; $1.00.

A second edition of Professor E. Grace White's *Textbook of General Biology* has appeared, and we can recommend it as a fine and complete guide for those wishing a broad background in modern biology. Written as a college text, the style is such that the layman without college preparation can read it with easy understanding. We like the organization into three sections and the inclusion of classification tables, list of references and a good glossary. There are 667 pages and 336 illustrations. The C. V. Mosby Co., 3525 Pine St., St. Louis, Mo. $3.00.

To the list of Biological Supply Houses given in our February, 1938, issue, add the following:

Biological Supply Laboratories, Ronceverte, W. Va. Slides and preserved materials, especially on medical subjects. Current list contains slides of tissues, parasites and bacteria.

Zoological Research Supply, Englewood, Fla. Catalog #7, 48 pages, lists preserved specimens from sponges through mammals. Many unusual species.

Most of our catalog offerings thus far have come from the optical companies, but this month we have for you a listing of prepared slides from one of the major supply houses. *Microscope Slides* is the title of a 32-page catalog just issued by Ward's Natural Science Establishment, Inc., 302 Goodman Street North, Rochester, N. Y. Here will be found listings of expertly prepared slides in botany, bacteriology, zoology, histology, embryology and parasitology. A set of such slides in a chosen field would make a splendid Christmas gift for yourself or for that friend who also has a microscope. Send a 3c stamp to Julian D. Corrington, NATURE MAGAZINE, 1214 Sixteenth St., N.W., Washington, D. C., and a copy of this catalog will be mailed you immediately.

If you are among the many whose chief love in microscopy is a study of the protozoa, you will be especially interested in announcement of a new book, the *Protozoology* of Dr. Richard R. Kudo. Although technically a second edition of this author's popular *Handbook of Protozoology,* the present volume is actually a new work, having been completely rewritten, and enlarged by more than 200 pages. Of the 291 illustrations, showing 2711 separate figures, only 59 were retained from the former book, the rest being new. The work is virtually an atlas on the subject, as well as a text, manual, or reference. No worker or teacher in this field can afford to be without this fine volume. Charles C. Thomas, Publisher, 220 East Monroe St., Springfield, Ill. $6.50.

Another most welcome new edition is the fourteenth of a famous text, Schafer's *Essentials of Histology,* now edited by Dr. H. M. Carleton, of Oxford University. This is a volume of 630 pages, 665 engravings, many in color, and 2 color plates, and is an honorable descendant of a line stretching back for more than fifty years. Subject matter is arranged as fifty lessons, and each of these has been thoroughly revised and brought up to date. One feature we have always liked and which makes Schafer especially serviceable for the amateur working alone—as well as useful for the student in class, or the teacher—is the material preceding the reading matter of each chapter, in which directions are given for laboratory study and slide-making technique. Thus, before discussions on the nature of blood cells, there appear full directions for making blood smears, fresh and stained, preparing slides of blood crystals, use of the blood-counting apparatus and other technique items. The book is hence a combined text and laboratory manual, and any histologist, regardless of his personal choice in texts, will tell you that Schafer is one of the best standard works on the subject ever published. Lea and Febiger, Washington Square, Philadelphia, Pa. $5.00.

Speaking of histology, here is something new. The *Handbook of Microscopic Characteristics of Tissues and Organs,* by Karl A. Stiles, Professor of Zoology at Coe College, Cedar Rapids, Iowa, is quite unlike anything we have seen before. It is a multigraphed volume of 62 pages and contains a mine of information of great practical value, excellent for students learning to recognize the many tissues and organs as seen under the microscope in courses on histology. The book is hence highly recommended for amateurs working without supervision, in connection with any standard text on the subject. One is told what to look for and how each part of every structure will appear, together with summaries and tables and lists of objects that are apt to be confusing. Order from the author at $1.50, postpaid. Discounts for quantity.

Under the Microscope is a department of NATURE MAGAZINE designed for those readers interested in microscopy and maintains a service to render assistance with problems in this field. You are invited to take advantage of this service. Address all inquiries to Julian D. Corrington, NATURE MAGAZINE, 1214 Sixteenth St., N.W., Washington, D. C.

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Official organ, *Nature Magazine*, Washington, D. C.

Address all communications concerning the Society to Dr. Corrington at Chestertown, Md. Application for Membership form sent on request. Dues, one year, fifty cents; two years, one dollar.

On a wall over the Secretary's desk is a large map of the United States and Canada and a smaller insert map of the world on which are many red-headed map tacks. These always intrigue the visitor, to whom it is explained that they depict distribution of membership in the ASAM. The markers cluster in masses around southern New England, New York City, Philadelphia, Baltimore, Chicago, Los Angeles and San Francisco, while much of the general area of New York State, New Jersey, Pennsylvania and Ohio is rather thickly studded. Thirty-seven states and the District of Columbia are represented by at least one tack each, the eleven in which we have as yet no representation being N. H., Vt., Va., S. C., Miss., Ark., N. D., S. D., Mont., Wyo., and Nev. In addition there are members in five Canadian provinces—Que., Ont., Sask., Alta., and B. C., and also in Cuba, Puerto Rico, Hawaii, Philippines and England. Undoubtedly the war has nipped a very promising foreign expansion, and we sadly mused on the fate of some Certificates of Membership recently mailed to England. Will they ever reach the young men to whom they were sent?

Introducing some new members, there is Professor Karl A. Stiles, head of the Department of Zoology at Coe College, Cedar Rapids, Iowa, who is interested in putting in a Chapter among his students. A review of one of his books appears on this page. Also Professor Datus M. Hammond, who teaches zoology and entomology at Utah State Agricultural College, Logan, Utah. Orris D. Hawks and Gabriel Chiano are bacteriologists with the Schwarz Laboratories, Inc., Chemists and Engineers, 202 E. 44th St., New York City. Paul B. Bunton represents the Spencer Lens Company in Washington, D. C., with offices at 1419 H St., N.W., and writes that he will be glad to have all D. C. members drop in and get acquainted, and offers to assist them with any problems or advice.

The name selected by the first group to apply for a Charter is that of the first authenticated inventor of the microscope. Marlowe W. Hartung, Jr., and his Allentown, Pa., friends have selected as their title the *Janseen Chapter* of the ASAM, and their Charter has been duly approved and awarded.

Any readers in the Minneapolis-St. Paul area interested in organizing a Chapter should communicate with T. S. Carley, 2848 Sunset Blvd., Minneapolis; phone Walnut 3284. Mr. Carley has worked very diligently in trying to get a local study group assembled.

Lost on Katahdin

Last summer newspaper readers far from Maine's rocky Mt. Katahdin followed what, day after day, appeared to be a fruitless search for a twelve-year-old boy lost from his companions above timberline. Nine days later the boy emerged from the wild, emaciated and spent. The story of this nine days is told in *Donn Fendler, Lost on a Mountain in Maine.* The story is in Donn's words as given piecemeal to Joseph B. Egan during a stay with Mr. Egan at the latter's cottage on Cape Cod. The story was extracted at odd moments during the enjoyment of normal boy activities, and with the aid of Donn's twin brother, Ryan. The result is one of the most engrossing little books we have ever read. It is a simple statement of a grueling experience in which stamina and innate courage triumphed unbelievably.

A Boy Scout, Donn drew upon such general bits of woodland knowledge as are vouchsafed an urban boy—such as following a stream to civilization. But he had no equipment of any kind; no matches; after the first day, no shoes; after the second, no pants. He lived on berries and water, denying himself berries he did not know and drinking only stream water. Many of his devices for keeping alive were born of instinct, after he had rationalized his predicament and convinced himself that he must keep his head.

In this story there is no attempt on Donn's part to glorify his successful fight against odds, or to dramatize himself. Nor does Mr. Egan allow himself, as collaborator, to interject any such note. This natural restraint on the boy's part, and this wisdom on the part of his Boswell, combine to make this book notably worthwhile. We commend it to all boys and to all parents of boys. Published by the Welles Publishing Company, Wellesley, Mass., it sells for one dollar. R. W. W.

All in the Washing

Hikers will be interested that a method of washing wool hose has been discovered that makes the washed hose easier on the feet. The process eliminates acids and metallic salts, with the result that the hiker has "drier" feet and the hose wear better. The process also does away with the "woolly" odor that is nearly always present in wool hose.

Leisure Books

Entitled *3000 Books of Leisure,* a useful bibliography has been published in a second edition by the book department of *Leisure,* 683 Atlantic Avenue, Boston, Mass. It gives a classified listing of many titles useful to hobbyists in many fields. The bibliography omits the name of the publisher, however, since its object is to stimulate sales direct to the book department of this magazine, but this does not impair the usefulness of the compilation.

How to Prune

Pruning trees, shrubs and other perennial growths is an important part of gardening and often done badly by the uninformed. A useful little booklet on this subject comes to our attention. It is entitled *Secrets of Success in Pruning* and is available for ten cents from Seymour Smith and Son, Oakville, Connecticut. We are going to take ours home and see that the Japanese maple that needs pruning gets the proper attention.

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CHRISTMAS SEALS

Help to Protect Your Home from Tuberculosis

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